## PATENT LITERATURE BIBLIOGRAPHIC DATABASES:

```
Set     Items   Description
S1       8531   (STRUCTUR? OR HINGE? OR GIMBAL? OR BEAM? ?)(20N)(HDD OR
DI-
             SC()DRIVE? OR DISK()DRIVE? OR DIS?DRIV? OR HARDDRIV? OR
HARD(-
             )DRIV?)
S2       8073   HEAD()SUSPENSION? OR ACTUATOR(2N)(ARM OR ARMS)
S3     109499   HEAD()(SLIDER? OR GIMBAL? OR STACK? OR BEAM? ? OR
HINGE?) -
             OR MAGNET?()(SLIDER? OR DRIVE? OR HEAD? ?)
S4     207502   DAMPING OR DAMPED OR DAMPER? ?
S5     151437   (VIBRAT? OR WOBBL? OR BEND? OR FLEXUR? OR SWAY? OR
TWIST? -
             OR TORSION? OR TORQU? OR OSCILLAT? OR NUTAT? OR PALPITAT?
OR -
             SHIMM? OR TREMOR? OR QUIVER? OR FLEX? OR DEFLEC? OR
DEFLEX? OR
              RESONAN?()FREQUENC?)(3N)(DISSIPAT? OR LESSEN? OR PREVENT?
OR
             STOP? ? OR STOPP? OR ABSORB?)
S6      46181   (VIBRAT? OR WOBBL? OR BEND? OR FLEXUR? OR SWAY? OR
TWIST? -
             OR TORSION? OR TORQU? OR OSCILLAT? OR NUTAT? OR PALPITAT?
OR -
             SHIMM? OR TREMOR? OR QUIVER? OR FLEX? OR DEFLEC? OR
DEFLEX? OR
              RESONAN?()FREQUENC?)(3N)(HALT? OR ARREST? OR LIMIT? OR
RESTR-
             ICT? OR RETARD? OR RESTRAIN?)
S7      48858   (VIBRAT? OR WOBBL? OR BEND? OR FLEXUR? OR SWAY? OR
TWIST? -
             OR TORSION? OR TORQU? OR OSCILLAT? OR NUTAT? OR PALPITAT?
OR -
             SHIMM? OR TREMOR? OR QUIVER? OR FLEX? OR DEFLEC? OR
DEFLEX? OR
              RESONAN?()FREQUENC?)(3N)(CONSTRAIN? OR IMPED? OR HINDER?
OR -
             CURB? OR PREMPT? OR DETER? OR AVOID?)
S8      23465   (VIBRAT? OR WOBBL? OR BEND? OR FLEXUR? OR SWAY? OR
TWIST? -
             OR TORSION? OR TORQU? OR OSCILLAT? OR NUTAT? OR PALPITAT?
OR -
             SHIMM? OR TREMOR? OR QUIVER? OR FLEX? OR DEFLEC? OR
DEFLEX? OR
              RESONAN?()FREQUENC?)(3N)(PRECLU? OR INHIBIT? OR SUBDU? OR
OF-
             FSET? OR MINIMI? OR COUNTERACT? OR ALLEVIAT?)
S9      48627   (VIBRAT? OR WOBBL? OR BEND? OR FLEXUR? OR SWAY? OR
TWIST? -
             OR TORSION? OR TORQU? OR OSCILLAT? OR NUTAT? OR PALPITAT?
OR -
             SHIMM? OR TREMOR? OR QUIVER? OR FLEX? OR DEFLEC? OR
DEFLEX? OR
```

```
             RESONAN?()FREQUENC?)(3N)(SQUELCH? OR QUELL? OR ELIMINAT?
OR -
            CURTAIL? OR ATTENUAT? OR BRAKE? OR BRAKING OR DAMPEN?)
S10      3287   S1:S3 AND S4:S9
S11        14   (MODULUS OR MODULI)(2N)ELASTIC?
S12        49   (ELASTIC??? OR YOUNG? ? OR VISCOELAST?)(2N)(MODULI OR
MODU-
            LUS OR COEFFICIENT? ? OR CO()EFFICIENT? ? OR DEFORMAT?)
S13         0   (TENSILE(2N)STRESS)(5N)(TENSILE(2N)STRAIN)
S14         0   (MODULUS OR MODULI)(2N)(BULK OR SHEAR OR PWAVE OR
P()WAVE)
            OR POISSON?(2N)RATIO OR LAME?(2N)PARAMET?
S15         2   GIGAPASCAL? OR GIGA()PASCAL? OR GPA OR GPAS
S16         0   KILOBAR? OR KILO()(BAR OR BARS)
S17         0   MEGAPASCAL? OR KILOPASCAL? OR HECTOPASCAL? OR (MEGA OR
KILO
             OR HECTO)()PASCAL? OR HPA OR HPAS
S18         2   TORR OR TORRS OR MILLIBAR?
S19         8   KB OR MB OR KBS OR MBS OR DYNE? ?(2N)(CM OR CM2 OR CMS
OR -
            CMS2 OR CENTIMET? OR SQUAREDCENTIMET? OR SQCENTIMET? OR
SQUAR-
            ECENTIMET?)
S20        19   HERTZ OR HZ
S21        12   MEGAHERTZ? OR MHZ OR KILOHERTZ? OR KHZ
S22      1608   TWO OR SECOND? OR 2ND OR BOTH OR PAIR OR TWIN OR TANDEM
OR
            TWOSOME OR TWOFOLD OR DOUBLE? OR DUPLE? OR TUPLE?
S23         3   AU=(SASSINE J? OR SASSINE H? OR SASSINE JH OR SASSINE
HJ)
S24         3   AU=(SASSINE, J? OR SASSINE, H? OR SASSINE, JH OR
SASSINE, -
            HJ)
S25         4   AU=(BHATTACHARYA S? OR BHATTACHARYA, S?)
S26         2   AU=(HUTCHINSON A? OR HUTCHINSON AJ OR HUTCHINSON, A? OR
HU-
            TCHINSON, AJ)
S27         2   AU=(LIMMER J? OR LIMMER JD OR LIMMER, J? OR LIMMER, JD)
S28         0   SASSINE(2N)(JOE OR JOSEPH) OR BHATTACHARYA(2N)SAND? OR
HUT-
            CHINSON(2N)(ANDREW OR ANDY) OR LIMMER(2N)JOEL?
S29      2506   IC=(G11B? OR G06F? OR C08J? OR F16F?)
S30      1661   MC=(T03? OR A05? OR A88? OR A05? OR A12? OR A18? OR
A28? OR
             P73? OR Q63?)
S31         7   S23:S28
S32         7   IDPAT (sorted in duplicate/non-duplicate order)
S33         7   IDPAT (primary/non-duplicate records only)
S34      3280   S10 NOT S31
S35         0   S34 AND S11:S14 AND S15:S19 AND S20:S21
S36         2   S34 AND S15:S19 AND S20:S21
S37         2   IDPAT (sorted in duplicate/non-duplicate order)
S38         2   IDPAT (primary/non-duplicate records only)
S39      3278   S34 NOT S36
S40         5   S39 AND S11:S14 AND S15:S21
S41         5   IDPAT (sorted in duplicate/non-duplicate order)
S42         5   IDPAT (primary/non-duplicate records only)
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? **show files**

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File 347:JAPIO Dec 1976-2009/Aug(Updated 091130)
         (c) 2009 JPO & JAPIO
File 350:Derwent WPIX 1963-2009/UD=200979
         (c) 2009 Thomson Reuters
```

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**Dialog eLink:** Order File History
33/5,K/3 (Item 3 from file: 350)
DIALOG(R)File 350: Derwent WPIX
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0015145695 *Drawing available*
WPI Acc no: 2005-495269/200550
**Disc drive head gimbal assembly, has damping layer placed in a pattern that extends onto surface of suspension component, and sealing layer that is non-friable covers damping layer**
Patent Assignee: SEAGATE TECHNOLOGY LLC (SEAG)
Inventor: BOUTAGHOU Z; HIPWELL R L; **LIMMER J D**; **SASSINE J H**; BOUTAGHOU Z E

| Patent Family ( 2 patents, 1 countries ) | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Patent Number** | **Kind** | **Date** | **Application Number** | **Kind** | **Date** | **Update** | **Type** |
| US 20050135013 | A1 | 20050623 | US 2003744266 | A | 20031222 | 200550 | B |
| US 7420778 | B2 | 20080902 | US 2003744266 | A | 20031222 | 200859 | E |

Priority Applications (no., kind, date): US 2003744266 A 20031222; US 2003744266 A 20031222

| Patent Details | | | | | |
|---|---|---|---|---|---|
| **Patent Number** | **Kind** | **Lan** | **Pgs** | **Draw** | **Filing Notes** |
| US 20050135013 | A1 | EN | 22 | 20 | |

**Alerting Abstract** US A1
NOVELTY - The assembly has a suspension component with a surface (200) extending over a flexible region (184) of the component. A damping layer (182) is placed in a pattern that extends onto the surface. A sealing layer (180) covers the damping layer, and the sealing layer is non-friable. A discrete boundary is in between the damping and sealing layers. A sealed housing surrounds the suspension component, damping and sealing layers.
DESCRIPTION - An INDEPENDENT CLAIM is also included for a process of making a disc drive head gimbal assembly.

USE - Used in a disc drive.
ADVANTAGE - The assembly greatly increases strain in the damping layer and makes the damping layer more effective in damping vibrations.
DESCRIPTION OF DRAWINGS - The drawing shows a sealing layers and damping layers disposed on flexible regions of suspension components.
180 Sealing layer
182 Damping layer
184 Flexible region
188 Disc drive head gimbal assembly
200 Surface

[0063] FIGS. 19-20 illustrate a graph of spectral distribution of vibration in a suspension component with and without use of a damper layer and sealing layer such as that illustrated in FIGS. 17-18.

[0064] In FIG. 19, a vertical axis 480 represents in-plane lateral off track vibration of a read/write head in microinches, and a horizontal axis 482 represents frequency in hertz. A dashed line 484 represents results without the use of damper and a solid line 486 represents results with the use of a damping and sealing layer as described above in connection with FIGS. 17-18. As shown in FIG. 19, the in-plane lateral off track motion due to strain is reduced by a factor of about 10.

[0065] In FIG. 20, a vertical axis 490 represents out-of-plane vibration of a read/write head in microinches, and a horizontal axis 492 represents frequency in hertz. A dashed line 494 represents results without the use of damper and a solid line 496 represents results with the use of a damping and sealing layer as described above in connection with FIGS. 17-18. As shown in FIG. 20, the out-of-plane lateral off track motion due to strain is reduced by a factor of about 10.

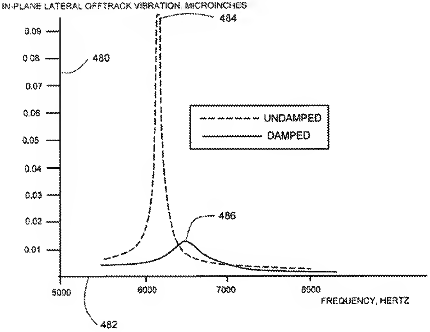
IN-PLANE LATERAL OFFTRACK VIBRATION, MICROINCHES
484
0.09
0.08
480
0.07
0.06
UNDAMPED
DAMPED
0.05
0.04
0.03
0.02
486
0.01
5000
6000
7000
8000
FREQUENCY, HERTZ
482

FIG. 19

**Dialog eLink:** Order File History
38/5,K/1 (Item 1 from file: 350)
DIALOG(R)File 350: Derwent WPIX
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0009252879
WPI Acc no: 1999-180480/199915
XRAM Acc no: C1999-052579
**Composite damping material of a porous material**
Patent Assignee: GORE ENTERPRISE HOLDINGS INC (GORE)
Inventor: GENTILE M M; PRINCIPE F; SUTTON S P

| Patent Family ( 8 patents, 75 countries ) | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Patent Number** | **Kind** | **Date** | **Application Number** | **Kind** | **Date** | **Update** | **Type** |
| WO 1999007775 | A1 | 19990218 | WO 1998US11047 | A | 19980529 | 199915 | B |
| AU 199877086 | A | 19990301 | AU 199877086 | A | 19980529 | 199928 | E |
| US 5965249 | A | 19991012 | US 1997908619 | A | 19970807 | 199949 | E |
| EP 1002008 | A1 | 20000524 | EP 1998925050 | A | 19980529 | 200030 | E |
| | | | WO 1998US11047 | A | 19980529 | | |
| CN 1266447 | A | 20000913 | CN 1998808048 | A | 19980529 | 200062 | E |
| JP 2001512763 | W | 20010828 | WO 1998US11047 | A | 19980529 | 200156 | E |
| | | | JP 2000506266 | A | 19980529 | | |
| EP 1002008 | B1 | 20020320 | EP 1998925050 | A | 19980529 | 200221 | E |
| | | | WO 1998US11047 | A | 19980529 | | |
| DE 69804318 | E | 20020425 | DE 69804318 | A | 19980529 | 200235 | E |
| | | | EP 1998925050 | A | 19980529 | | |
| | | | WO 1998US11047 | A | 19980529 | | |

**Alerting Abstract** WO A1
1 Composite **damping** material comprises a porous material (2) and a second material (1) having a mechanical droop time of less than 10-4 seconds within the pores of the porous material. The resulting **damping** material has a mechanical droop displacement less than 1mm, and a dynamic loss modulus master curve value above 1x109 **dyne/ cm2** at at least one point in the frequency range 0.1 to 105 **Hz**. Also claimed is such a **damping** material bonded to a surface susceptible to vibration. In **damping** vibration of a surface of a disc drive assembly, vehicle, aircraft, sports equipment, electronic or electronic cable, or machining system. Incorporation of mechanically unstable second material within the pores of a relatively stable material provides a material with outstanding **damping**

properties with negligible cold flow. In the EMBODIMENTS the porous material can be ceramic, glass, metal or, particularly, polytetrafluoroethylene. The second material can be epoxy, fluorocarbon, polyurethane, acrylic, silicone, polyisobutylene or, particularly, oligomeric perfluorocarbon or uncured novolak epoxy resin.The figure shows the **damping** material. porous material 1 unstable **damping** material.2

**Composite damping material of a porous material** ... **Abstract** ...1 Composite **damping** material comprises a porous material (2) and a second material (1) having a mechanical droop time of less than 10-4 seconds within the pores of the porous material. The resulting **damping** material has a mechanical droop displacement less than 1mm, and a dynamic loss modulus master curve value above 1x109 **dyne/ cm2** at at least one point in the frequency range 0.1 to 105 **Hz**. Also claimed is such a **damping** material bonded to a surface susceptible to vibration. In **damping** vibration of a surface of a disc drive assembly, vehicle, aircraft, sports equipment, electronic or electronic cable, or machining system. Incorporation of mechanically unstable second material within the pores of a relatively stable material provides a material with outstanding **damping** properties with negligible cold flow. In the EMBODIMENTS the porous material can be ceramic, glass, metal or, particularly, polytetrafluoroethylene. The second material can be epoxy, fluorocarbon, polyurethane, acrylic, silicone, polyisobutylene or, particularly, oligomeric perfluorocarbon or uncured novolak epoxy resin.The figure shows the **damping** material. porous material 1 unstable **damping** material.2 Original Publication Data by AuthorityArgentina**Publication No. Original Abstracts:**A new composite **damping** material is presented **which** exhibits an enhanced ability to dampen mechanical **oscillations**. The **enhanced damping properties** of this **material** are achieved through the entrapment of highly viscous **damping** fluids within the **pores** of a porous material (such as: an expanded polymer, felt, foam, fabric, metal, etc.). The entrapment of the fluid within the porous scaffold prevents flow, providing a stable composite which may be shaped into useful articles. Such a construct allows utilization of the high performance **damping** properties of fluids **which**, in pure form, are too fluid-like for most practical applications (which typically require a solid, stable, material). This composite, possessing **damping** performance approaching that **of** certain fluids, combined with stability in a solid form,can be used in many applications where materials are needed to damp the vibration of mechanical systems. Such applications include, but are not limited to, **damping** of **vibrations** which **produce** noise **or** degrade performance in airplanes, automobiles, space **structures**, machine tools, sporting **goods**, **disk drive** components and **assemblies**, **electrical**/electronic components such as transformers, electrical cables, etc. In addition, these composites may be used to alter or tune the mechanical response of a variety... ... A new composite damping material is **presented** which exhibits an enhanced ability **to** dampen mechanical oscillations. The enhanced **damping** properties of **this material** are **achieved** through the **entrapment** of highly viscous damping fluids within **the** pores of a porous material (**such** as: an expanded polymer, felt, foam, fabric, metal, etc.). The entrapment of the fluid within the porous scaffold prevents flow, providing a stable composite which may be shaped into useful articles. Such a construct allows utilization of the high performance damping properties of **fluids** which, in pure form, are **too** fluid-like for most practical applications (which typically require a solid,

stable, material). This composite, possessing damping performance approaching **that** of certain fluids, combined with **stability** in a solid form, can be used in many applications where materials are needed to damp the vibration of mechanical systems. Such applications include, but are **not** limited to, damping **of** vibrations **which** produce **noise** or **degrade** performance **in** airplanes, **automobiles**, space structures, machine tools, **sporting** goods, disk drive components **and assemblies**, electrical/electronic components such **as transformers**, electrical cables, etc. In addition, these composites may be used to alter or tune the mechanical response of a variety of systems to produce desired... ... A new composite damping material is **presented** which exhibits an enhanced ability to dampen mechanical oscillations. **The enhanced damping** properties of **this** material are achieved through the **entrapment** of **highly** viscous damping **fluids** within **the** pores of a porous material (such as: an expanded polymer, **felt**, foam, fabric, metal, etc.). The entrapment of the fluid within the porous scaffold prevents flow, providing a stable composite which may be shaped into useful articles. Such a construct allows utilization of the high performance damping properties of **fluids** which, in pure form, are too fluid-like for most **practical** applications (which typically require a solid, stable, material). This composite, possessing damping performance approaching **that** of certain fluids, combined with stability in a solid form,**can** be used in many applications where materials are needed to damp the vibration of mechanical systems. Such applications include, but are not limited to, damping **of vibrations which** produce **noise** or degrade performance in airplanes, automobiles, **space** structures, machine tools, **sporting** goods, disk drive components **and assemblies**, electrical/electronic components such **as** transformers, electrical cables, etc. **In addition**, these composites may be used to alter or tune the mechanical response of a variety of systems to produce desired impulse or vibrational response... ...... ... A composite **damping** material comprised of:a) a porous material, andat least one second material having a mechanical droop time, as defined by test method **3**, of less then 104 seconds,

said second material being within the pores of said porous material; and said composite having a mechanical droop displacement less than 1 mm, as defined by test method 4, and having a dynamic loss modulus master curve value greater than 1 x 109 **dyne/cm2**, as defined by test method 2, at at least one point within the frequency band between 0.1 and 105 **Hz**, as defined by analysis method 1. 1.A composite **damping** material **comprised** of:a) a porous material, andb) at least one second material having a mechanical droop time of less than 104 seconds,said second material... ... material; and said composite having a mechanical droop displacement less than 1 mm, and having a dynamic loss modulus master curve value greater than 1x109 **dyne/cm2** at at least one point within the frequency **band** between 0.1 and 105 **Hz.>**

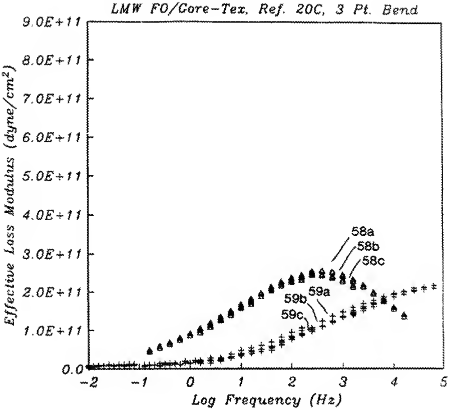
LMW FO/Core-Tex, Ref. 20C, 3 Pt. Bend
Effective Loss Modulus (dyne/cm²)
9.0E+11
8.0E+11
7.0E+11
6.0E+11
5.0E+11
4.0E+11
3.0E+11
2.0E+11
1.0E+11
0.0
-2
-1
0
1
2
3
4
5
Log Frequency (Hz)
58a
58b
58c
59a
59b
59c

FIG. 18

**Dialog eLink:** Order File History
38/5,K/2 (Item 2 from file: 350)
DIALOG(R)File 350: Derwent WPIX
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0003980162
WPI Acc no: 1987-073994/198711
XRAM Acc no: C1987-030799
XRPX Acc No: N1987-056072
**Casing for magnetic tape cassette - made from calcium carbonate or barium sulphate filled polyolefin resin to attenuate external vibration**
Patent Assignee: HITACHI MAXELL KK (HITM)
Inventor: SASAKI S

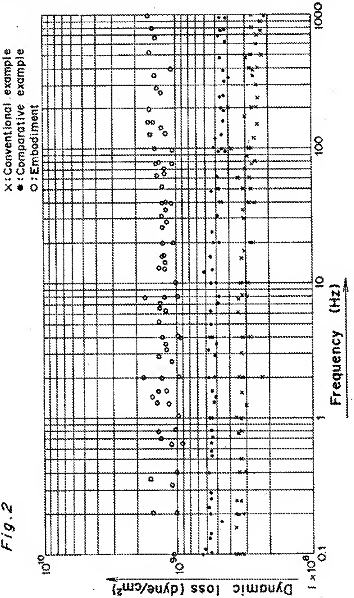
| Patent Family ( 6 patents, 5 countries ) | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Patent Number** | **Kind** | **Date** | **Application Number** | **Kind** | **Date** | **Update** | **Type** |
| EP 214604 | A | 19870318 | EP 1986112135 | A | 19860902 | 198711 | B |
| JP 62057182 | A | 19870312 | JP 1985195174 | A | 19850904 | 198716 | E |
| US 4791484 | A | 19881213 | US 1986903449 | A | 19860904 | 198901 | E |
| EP 214604 | B1 | 19921202 | EP 1986112135 | A | 19860902 | 199249 | E |
| DE 3687201 | G | 19930114 | DE 3687201 | A | 19860902 | 199303 | E |
| | | | EP 1986112135 | A | 19860902 | | |
| KR 199403670 | B1 | 19940425 | KR 19866856 | A | 19860820 | 199607 | E |

A tape cartridge has a case made from a compsn. comprising a polyolefin resin and 45-65 wt.% w.r.t. compsn. of a particulate filler comprising at least one of $CaCO_3$ and $BaSO_4$, the tape cartridge having a dynamic loss of more than 1 x 10 power 9 **dyne/cm2** within the frequency range 0.1-1000 **Hz**.
ADVANTAGE - The tape cartridge tape **attenuates oscillations** from outside sources within the given frequency range, thus **avoiding** induced **oscillation** of the tape and consequent modulation noise caused by miscontact between the running tape and the **magnetic head**. The filled polyolefin material can be moulded by conventional injection moulding processes.

...**made from calcium carbonate or barium sulphate filled polyolefin resin to attenuate external vibration Alerting Abstract** ...particulate filler comprising at least one of $CaCO_3$ and $BaSO_4$, the tape cartridge having a dynamic loss of more than 1 x 10 power 9 **dyne/ cm2** within the frequency range 0.1-1000 **Hz**. ... ...ADVANTAGE - The tape cartridge tape **attenuates oscillations** from outside sources within the given frequency range, thus **avoiding** induced **oscillation** of the tape and consequent modulation noise caused by miscontact between the running tape and the **magnetic head**. The filled polyolefin material can be moulded by conventional injection moulding

processes. **Equivalent Alerting Abstract** ...ADVANTAGE - The case exhibits dynamic loss of over 10 power 9 **dyne/cm2** within oscillation frequency range 0.1-1000 **Hz**. Modulation noise that occurs because of outside oscillation is suppressed while softness and hardness similar to a conventional tape cartridge can be obtd. (6pp) **Abstracts:**particle made of at least one of calcium carbonate and barium sulfate, said tape cartridge having a dynamic loss of more than 1 x 109 **dyne/cm2** within the range of oscillation frequency **of 0**.1 **Hz** to 1000 **Hz**. Accordingly, the tape cartridge according to the **present** invention can **prevent** a running tape arranged in the tape cartridge from **oscillating** because an outside **oscillation** is **attenuated** in the tape cartridge, and also the tape **cartridge** can **reduce** a modulation noise occurred by the outside oscillation... ... filler includes particles made of at least one of calcium carbonate and barium sulfate. The tape cartridge has a dynamic loss of more than 1x109 **dyne/cm2** within a range of oscillation frequency of 0.1 **Hz** to 1000 **Hz**. Accordingly, the tape cartridge **of the** present invention can **prevent** a running tape **arranged** in the tape cartridge **from** oscillating since **outside oscillation** is **attenuated** in the tape cartridge. Also the tape cartridge can reduce modulation noise which occurs because of **the** outside **oscillation.**
**>...Claims:particulate filler comprising at least one of $CaCO_3$ and $BaSO_4$, the tape cartridge having a dynamic loss of more than 1 x 10 power 9 dyne/cm2 within the frequency range 0.1-1000 Hz.... ... and/or said barium sulfate by weight of said plastic material, so that said tape cartridge having a dynamic loss of more than 1x104 N/cm2 (1x109 dyne/cm2) within the range of an oscillation frequency of 0.1 Hz to 1000 Hz. >**

Fig. 2


X : Conventional example
● : Comparative example
O : Embodiment
Dynamic loss (dyne/cm²)
10¹⁰
10⁹
1 × 10⁸
Frequency (Hz)
0.1
1
10
100
1000

**[2nd strategy]:**

```
Set      Items   Description
S1      207502   DAMPING OR DAMPED OR DAMPER? ?
S2      151437   (VIBRAT? OR WOBBL? OR BEND? OR FLEXUR? OR SWAY? OR
TWIST? -
             OR TORSION? OR TORQU? OR OSCILLAT? OR NUTAT? OR PALPITAT?
OR -
             SHIMM? OR TREMOR? OR QUIVER? OR FLEX? OR DEFLEC? OR
DEFLEX? OR
              RESONAN?()FREQUENC?)(3N)(DISSIPAT? OR LESSEN? OR PREVENT?
OR
             STOP? ? OR STOPP? OR ABSORB?)
S3       46181   (VIBRAT? OR WOBBL? OR BEND? OR FLEXUR? OR SWAY? OR
TWIST? -
             OR TORSION? OR TORQU? OR OSCILLAT? OR NUTAT? OR PALPITAT?
OR -
             SHIMM? OR TREMOR? OR QUIVER? OR FLEX? OR DEFLEC? OR
DEFLEX? OR
              RESONAN?()FREQUENC?)(3N)(HALT? OR ARREST? OR LIMIT? OR
RESTR-
             ICT? OR RETARD? OR RESTRAIN?)
S4       48858   (VIBRAT? OR WOBBL? OR BEND? OR FLEXUR? OR SWAY? OR
TWIST? -
             OR TORSION? OR TORQU? OR OSCILLAT? OR NUTAT? OR PALPITAT?
OR -
             SHIMM? OR TREMOR? OR QUIVER? OR FLEX? OR DEFLEC? OR
DEFLEX? OR
              RESONAN?()FREQUENC?)(3N)(CONSTRAIN? OR IMPED? OR HINDER?
OR -
             CURB? OR PREMPT? OR DETER? OR AVOID?)
S5       23465   (VIBRAT? OR WOBBL? OR BEND? OR FLEXUR? OR SWAY? OR
TWIST? -
             OR TORSION? OR TORQU? OR OSCILLAT? OR NUTAT? OR PALPITAT?
OR -
             SHIMM? OR TREMOR? OR QUIVER? OR FLEX? OR DEFLEC? OR
DEFLEX? OR
              RESONAN?()FREQUENC?)(3N)(PRECLU? OR INHIBIT? OR SUBDU? OR
OF-
             FSET? OR MINIMI? OR COUNTERACT? OR ALLEVIAT?)
S6       48627   (VIBRAT? OR WOBBL? OR BEND? OR FLEXUR? OR SWAY? OR
TWIST? -
             OR TORSION? OR TORQU? OR OSCILLAT? OR NUTAT? OR PALPITAT?
OR -
             SHIMM? OR TREMOR? OR QUIVER? OR FLEX? OR DEFLEC? OR
DEFLEX? OR
              RESONAN?()FREQUENC?)(3N)(SQUELCH? OR QUELL? OR ELIMINAT?
OR -
             CURTAIL? OR ATTENUAT? OR BRAKE? OR BRAKING OR DAMPEN?)
S7      476555   S1:S6
S8        1910   (MODULUS OR MODULI)(2N)ELASTIC?
S9        4990   (ELASTIC??? OR YOUNG? ? OR VISCOELAST?)(2N)(MODULI OR
MODU-
             LUS OR COEFFICIENT? ? OR CO()EFFICIENT? ? OR DEFORMAT?)
S10          6   (TENSILE(2N)STRESS)(5N)(TENSILE(2N)STRAIN)
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S11        261   (MODULUS OR MODULI)(2N)(BULK OR SHEAR OR PWAVE OR
P()WAVE)
             OR POISSON?(2N)RATIO OR LAME?(2N)PARAMET?
S12        302   GIGAPASCAL? OR GIGA()PASCAL? OR GPA OR GPAS
S13          3   KILOBAR? OR KILO()(BAR OR BARS)
S14         88   MEGAPASCAL? OR KILOPASCAL? OR HECTOPASCAL? OR (MEGA OR
KILO
              OR HECTO)()PASCAL? OR HPA OR HPAS
S15        135   TORR OR TORRS OR MILLIBAR?
S16        611   KB OR MB OR KBS OR MBS OR DYNE? ?(2N)(CM OR CM2 OR CMS
OR -
             CMS2 OR CENTIMET? OR SQUAREDCENTIMET? OR SQCENTIMET? OR
SQUAR-
             ECENTIMET?)
S17       2153   HERTZ OR HZ
S18       1361   MEGAHERTZ? OR MHZ OR KILOHERTZ? OR KHZ
S19     208602   TWO OR SECOND? OR 2ND OR BOTH OR PAIR OR TWIN OR TANDEM
OR
             TWOSOME OR TWOFOLD OR DOUBLE? OR DUPLE? OR TUPLE?
S20          4   AU=(SASSINE J? OR SASSINE H? OR SASSINE JH OR SASSINE
HJ)
S21          4   AU=(SASSINE, J? OR SASSINE, H? OR SASSINE, JH OR
SASSINE, -
             HJ)
S22          5   AU=(BHATTACHARYA S? OR BHATTACHARYA, S?)
S23          4   AU=(HUTCHINSON A? OR HUTCHINSON AJ OR HUTCHINSON, A? OR
HU-
             TCHINSON, AJ)
S24          4   AU=(LIMMER J? OR LIMMER JD OR LIMMER, J? OR LIMMER, JD)
S25          0   SASSINE(2N)(JOE OR JOSEPH) OR BHATTACHARYA(2N)SAND? OR
HUT-
             CHINSON(2N)(ANDREW OR ANDY) OR LIMMER(2N)JOEL?
S26        694   (STRUCTUR? OR HINGE? OR GIMBAL? OR BEAM? ?)(20N)(HDD OR
DI-
             SC()DRIVE? OR DISK()DRIVE? OR DIS?DRIV? OR HARDDRIV? OR
HARD(-
             )DRIV?)
S27        684   HEAD()SUSPENSION? OR ACTUATOR(2N)(ARM OR ARMS)
S28       2385   HEAD()(SLIDER? OR GIMBAL? OR STACK? OR BEAM? ? OR
HINGE?) -
             OR MAGNET?()(SLIDER? OR DRIVE? OR HEAD? ?)
S29      74129   IC=(G11B? OR G06F? OR C08J? OR F16F?)
S30      44058   MC=(T03? OR A05? OR A88? OR A05? OR A12? OR A18? OR
A28? OR
              P73? OR Q63?)
S31         13   S20:S25
S32         13   IDPAT (sorted in duplicate/non-duplicate order)
S33         13   IDPAT (primary/non-duplicate records only)
S34     476542   S7 NOT S31
S35         24   S34 AND S8:S11 AND S12:S16 AND S17:S18
S36         24   IDPAT (sorted in duplicate/non-duplicate order)
S37         24   IDPAT (primary/non-duplicate records only)
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File 347:JAPIO Dec 1976-2009/Aug(Updated 091130)
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**Composite for sound resonant board used in piano, contains foamed resin matrix containing oriented carbon fiber**
Patent Assignee: INOAC CORP KK (INOA-N); ONO A (ONOA-I); POLYURETHANE KASEI KK (POLY-N)
Inventor: ONO T

| Patent Family ( 1 patents, 1 countries ) | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Patent Number** | **Kind** | **Date** | **Application Number** | **Kind** | **Date** | **Update** | **Type** |
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| JP 2001306062 | A | JA | 8 | 6 | |

**Alerting Abstract** JP A
NOVELTY - The composite contains foamed resin matrix provided with carbon fiber. The carbon fiber in the resin matrix is oriented along one direction.
DESCRIPTION - An INDEPENDENT CLAIM is also included for sound resonant board containing resin matrix and carbon fiber.
USE - For sound resonant board (claimed) of piano, front plate of guitar and baryon genus musical instruments.
ADVANTAGE - The composite has high **Young**'s **modulus** ratio, low **damping** factor and strong anisotropy, as required for sound resonance board. The composite is not influenced by humidity. The composite is used as a substitute for timber, hence it is used for front plate of guitar, baryon genus and as resonant board of piano.
DESCRIPTION OF DRAWINGS - The figure shows the frequency response characteristics result of 1/3 octave band by tapping in Map and Sp.

**Alerting Abstract** ...ADVANTAGE - The composite has high **Young**'s **modulus** ratio, low **damping** factor and strong anisotropy, as required for sound resonance board. The composite is not influenced by humidity. The composite is used as a substitute for...
**Technology Focus** POLYMERS - Preferred Properties: The composite has density of 0.38-0.52 g/cm3, ratio (EL/GLR) of **Young**'s **modulus (EL)** and **shear modulus** (GLR) **of 5**-7, EL/(similar)r ratio of 18-30 and EL/ER ratio of 9-20. The **Young**'s **modulus (EL)** of **oriented** fiber is 9-15 **GPa**. The internal **friction** (QL-1) of oriented fiber is 4-10x10-3. The composite shows 3 peaks at 200-500 **Hz**, 1000-2000 **Hz** and 5000-7000 **Hz**, in the **frequency** response characteristics figure **of** 1/3 octave band by tapping.**Extension Abstract**

**[machine translation below]:**

## DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention]this invention relates to the composite for sound boards, and a sound board -- a still more detailed high ratio required for sound boards, such as musical instrument soundboard material, -- the composite of the new structure which was provided with Young's modulus, a low extinction ratio, and strong anisotropy, and was not influenced by humidity, and was excellent as a wood alternate material -- and -- future -- it is related with a sound board. This invention is widely used for the front board of a violin group musical instrument, the front board of a guitar, the soundboard of a piano, etc.
[0002]
[Description of the Prior Art]Musical instruments, such as a violin group and a piano, are wooden, and, as for each member used, tree species are limited, respectively. Especially a soundboard is most important member that opts for performances of a musical instrument, such as a tone, and soundboard material is sorted out still more severely from it. soundboard material -- grain -- a connoisseur -- the physical properties which a direct straight grain board is used and are demanded -- general -- the large ratio of small density (rho) and a grain direction (L) -- they are Young's modulus ($E_L$/rho) and a small extinction ratio ($Q_L^{-1}$). That is, it is light and the waist is ** echoed strongly. The cellulose of high elasticity with wood long in the direction of a trunk is the structure which it can express with the structure with which the cell wall and hole of the main ingredients were located in a line in parallel approximately, and is porosity, and had the feature of orthotropic anisotropy. Although the relation between the physical properties of wood and structure is studied from the former, the above-mentioned character which wood has originates in such a structure. On the other hand, by exhaustion of the wood resources by global environmental protection, deforestation, etc., acquisition of the good quality material is becoming difficult gradually, and development of an alternate material has become the urgent situation. However, since wood is living thing material, it is heterogeneous, its variation is large, and it receives the influence of humidity in the acoustical character greatly. wood -- the variation in construction material, and a check --

and it comes -- it is -- in order to generate the serious trouble for musical instrument products, a material control and a production process take a great labor and expense.
[0003]
[Problem(s) to be Solved by the Invention]This invention is made in view of the above-mentioned actual condition, and is a thing.
the purpose is alike -- a required high ratio -- the composite of the new structure which was provided with the outstanding acoustical character, such as Young's modulus, a low extinction ratio, and strong anisotropy, and was not influenced by humidity, and was excellent as a wood alternate material -- and -- future -- it is providing a sound board.

[0004]
[Means for Solving the Problem]This invention persons came to complete this invention, as a result of examining many things about a wood alternate material approximated to structure of wood of having outstanding acoustical character with which a wooden sound board is provided, such as the frequency response characteristic, and mechanical properties, such as Young's modulus and internal friction. namely, -- this invention can solve the above-mentioned various problems generated although wood is used therefore -- a high ratio required for musical instrument soundboard material -- it is related with composite for sound boards of a new structure where Young's modulus, a low extinction ratio, strong anisotropy, etc. are realizable, and a sound board using this.
[0005]Composite for sound boards of the 1st invention contains carbon fiber by which was allocated into a resin matrix which has an opening, and this resin matrix, and orientation was carried out to one way. A sound board of the 5th invention contains carbon fiber by which was allocated into a resin matrix which has an opening, and this resin matrix, and orientation was carried out to one way. Shape of this sound board, a size in particular, etc. are not limited, but are variously changed by the purpose and a use. For example, as the shape, plate-like, curvature shape, bending shape, a letter of folding, other shape, etc. can be used.
[0006]A base material which the above "resin matrix which has an opening" comprises with foamed resin is said. Although this foamed resin may be closed cell foam, open-cell foam, or foam provided with these both air bubbles, a continuation foaming float is usually mainly preferred [ foamed resin ] on processing and shaping. Expansion ratio of foam itself usually makes expansion ratio ten to 25 times preferably eight to 50 times, in order to consider it as moderate density (for example, about 0.38-0.52 g/cm3, preferably about 0.38-0.47 g/cm3) as a sound board. A raw material in particular of the above-mentioned resin matrix is not limited, for example, can be used as polyurethane, polyphenol, polypropylene, polyethylene, nylon, an acrylic resin, etc. In this, since it is easy to adjust polyurethane, especially rigid polyurethane to moderate density of about 0.38-0.50 g/cm3, they are preferred.
[0007]A PAN system etc. are preferred although a kind (kinds, such as manufacturing raw materials and a manufacturing method) in particular of above "carbon fiber" (a graphite fiber is included in addition in this.) is not limited. Usually, as this carbon fiber, although monofilament long shape textiles and continuous glass fiber are used, a staple fiber or its both can also be used. although loadings in particular of this carbon fiber are not limited, 3 - 20 capacity % is preferred to total volume of matrix resin and this carbon fiber -- more -- desirable -- five to 10 capacity % -- it is six to 8 capacity % still more

preferably.
[0008]What is necessary is just to carry out orientation of the above-mentioned carbon fiber into a matrix in one way. Since a layered product with the rigidity of a rear surface, intensity high as a laminated structure, and an interlayer's density low in order to obtain a compound board in which an acoustic feature nearer to wood is shown was preferred, made it more desirable for a surface and rear surface of a matrix to carry out orientation of the carbon fiber. In order to control orientation of carbon fiber, it is good also as composite to stiffen carbon fiber to which orientation of the desired distribution of condensation and rarefaction was beforehand established and carried out suitably with emulsion resin etc. by resin, form a sheet, and laminate foamed resin on this sheet. In this case, it is preferred to consider it as sandwich structure which put foamed resin between an interlayer by using a sheet of two sheets as a rear surface layer.
[0009]Density (rho) can be made into 0.38 - 0.52 $g/cm^3$ (preferably 0.38-0.50 g/cm3, more preferably 0.38-0.47 g/cm3) in the above-mentioned composite for sound boards, or a sound board ("composite for sound boards" is said hereafter.). When this density is too low, there are few injection rates of urethane resin and uniform shaping of a matrix becomes difficult. When too high-density, since a blowing pressure becomes high, it not only becomes heavy as a complex, but it becomes difficult to carry out orientation of the textiles uniformly. Especially a case of less than 0.38g[/cm ] $^3$ runs short of intensity as composite, and is not preferred. When exceeding 0.52 $g/cm^3$, it is heavy as a complex and a tone is spoiled. Especially in 0.38-0.50g[/cm ] $^3$ (especially 0.38-0.47$g/cm^3$), it excels in performance balance of an acoustic feature which is lightweight and is demanded.
[0010]in the above-mentioned composite for sound boards, etc. -- Young's modulus $E_L$ of a grain direction -- 9-15 -- (-- it can be preferably considered as 10 - 15). This $E_L$ affects a frequency characteristic. In the above-mentioned composite for sound boards, etc., a ratio ($E_L/G_{LR}$) of Young's modulus $E_L$ and shear-modulus $G_{LR}$ which are the indices which show a size of a shear strain can be set to 5.0-7.0 (preferably 5.5-7, more preferably 6-7). It is fully securable that elasticity is large in a value of this range, and rigidity is low. a ratio -- in a point of obtaining a sound board which bears Ryo Oto, a Young's modulus $E_L$/rho ratio is so preferred that it is large, and can be more preferably made or more into 24 20 or more 18 or more. A maximum of this ratio is usually about 30. Internal-friction $Q_L^{-1}$ of a grain direction is so preferred that it is small in a point that a first sound and a first sound sound vividly when a transient characteristic is influenced and it is considered as a musical instrument, and can be more preferably made or less into eight ten or less 12 or less. A minimum of this value is usually about four. $E_L$(Young's modulus of grain direction)/$E_R$ (Young's modulus of a grain direction and a direction which goes direct) which shows an index of the degree of different direction -- 9-20 -- desirable -- 10-20 -- it can be more preferably referred to as 11-20. as mentioned above, density (rho) -- 4 - $10x10^{-3}$ and $E_L/E_R$ can be set [ 0.38-0.52$g/cm^3$ and Young's modulus $E_L$ / 9-15, and $E_L/G_{LR}$ / 5.0-7.0, and an $E_L$/rho ratio ] to 9-20 for 18-30, and $Q_L^{-1}$. Preferably density (rho) 0.38-0.50$g/cm^3$ (still more preferably 0.38-0.47$g/cm^3$), 4 - $10x10^{-3}$ and $E_L/E_R$ can be set [ $E_L$ / 10-15, and $E_L/G_{LR}$ / 5.0-7.0, and an $E_L$/rho ratio ] to 10-20 (still more preferably 11-20) for 20-30 (still more preferably 22-30), and $Q_L^{-1}$.
[0011]In a frequency response characteristic figure of 1/3 octave band according [ on the above-mentioned composite for sound boards, etc., and ] to tapping, At least 200-500 Hertz, 1000-2000 Hertz, and 5000-7000 Hertz shall be equipped with each peak (namely,

at least three peaks). For example, 300-500 Hertz, 1500-1700 Hertz, and 5000-7000 Hertz shall be equipped with each peak (namely, at least three peaks). One peak and 1000-3000 Hertz shall be equipped with two peaks, and 250-500 Hertz shall be equipped with one peak (namely, at least four peaks) at 5000-7000 Hertz.
[0012]
[Embodiment of the Invention]Hereafter, the examples 1-6 of an examination are given, and this invention is explained concretely.
(1) production [ of the board for sound boards for an examination concerning the examples 1-5 of an examination ] ** -- the urethane stock for rigid urethane foam first shown in the textiles shown below and the following, as shown in Table 1, (a) By changing the kind of textiles to be used, the volume fraction (VF) of the textiles in the (b) matrix, and the expansion ratio (namely, density: rho) of the urethane stock for rigid urethane foam which carries out (c) use, As shown in Table 1, sound board No.1 for an examination from which density and an acoustic feature differ - 5 (examples 1-5 of an examination) were manufactured.
[0013]** The fundamental manufacturing process is as follows. First, the bundled long shape carbon fiber bundle (in sizing carbon fiber and Table 1, it carries out abbreviated to "CF".) is unfolded. This carbon fiber shows the thing monofilament. And a 30-cm angle monotonous metallic mold (cavity depth: 3 mm) is prepared. It sticks on the whole surface so that carbon fiber may be arranged to the fluctuated type of this metallic mold in abbreviated one way. Let this amount of carbon fiber to blend be the quantity which becomes a floor area ratio shown in Table 1. The example 5 of an examination unfolded the glass fiber bundle, and used it similarly. The predetermined urethane stock for rigid urethane foam shown below is uniformly slushed into the center section of this bottom part. Then, a punch is laid promptly. The crevice is established so that degassing may be possible for any four corners of a besides type and a bottom part. By neglecting it for 60 minutes, foam curing is carried out and 40 ** of hard foaming polyurethane containing textiles is formed. It took out from the mold and the sound board for an examination (105x105x3 mm, No.1-5) was obtained.
[0014]** The raw material used for each example of an examination (refer to Table 1)
(a) "CF-1" (they are use and apparent-density;1.81 g/cm3 at the examples 1-3 of an examination); long shape carbon fiber (sizing carbon fiber, the Mitsubishi Rayon Co., Ltd. make, trade name : "TR50S12L")
(b) -- "CF-2";(they are use and apparent-density;1.95 g/cm3 at example 4 of examination); long shape carbon fiber (sizing carbon fiber.) (c) by Mitsubishi Rayon Co., Ltd. "GF"; (they are use and apparent-density;2.38 g/cm3 at the example 5 of an examination); long shape glass fiber (E glass), A liquid shown below in (d) "FP-1 - 5" made from Asahi Glass;, and B liquid are used. Respectively different expansion ratio was prepared by the method shown below.
(i) [A liquid] --; polyol: -- 100 weight section (only henceforth a "part"), Foam stabilizer: Two copies, catalyst:1.5 copy, foaming agent (water):1-2 copy, [B liquid]; crewed MDI, index;115, [A liquid / B liquid] =100/135 (in addition, this mixed liquor is this viscosity that will flow if it is neglected.) A reaction is slow in the low activity for workability reservation.
As the above-mentioned polyol as the polyether polyol of the hydroxyl value 300 which made propylene oxide react to a shook sirloin at triethanolamine, and the above-

mentioned foam stabilizer, Silicone foam stabilizer (N,N-dimethylcyclohexylamine was used as Toray Industries silicone company make, trade names "SH-193", and a catalyst.)
[0015](ii) Adjustment of the expansion ratio in each example of an examination below adjustment of expansion ratio, i.e., density, was performed as follows. In the example 1 of an examination, the carbon fiber of 20.9 weight sections was laid in the mold, and it carried out [ mold clamp ] promptly after pouring in 59.5 weight sections in A and the B liquid whole quantity. In the example 2 of an examination, it increased as injection-rate [ of the example 1 of an examination ] A, and B liquid whole-quantity 55.1 weight section. In the example 3 of an examination, the quantity of carbon fiber was increased to 21.6 weight sections on condition of the above-mentioned example 2 of an examination. In the example 4 of an examination, the quantity of the total injection rate of A and B liquid was increased to 81.8 weight sections to the example 2 of an examination. In the example 5 of an examination, the glass fiber of 20.8 weight sections was laid in the mold, and it carried out [ mold clamp ] promptly after pouring in 32.3 weight sections in A and the B liquid whole quantity.
[0016]The example 6 (No.6) of an examination shown in Table 1 and 2 used the Sitka spruce for soundboards (Sp) for comparison (drawing 2, four to 6 reference), created it in the shape of isomorphism, and was made into the test sample. This Sitka spruce (Sp) usually used what is used for soundboards, such as a violin and a piano. The result of maple material (Map) is also shown in drawing 2 for reference. In Table 1, "VF" shows a volume fraction and the calculated value according [ of a subscript / "L" / textiles, direction crossing at a right angle, and "t" ] to the rule of mixture in a grain direction and "R", respectively. Each property value, such as rigid urethane foam (FP), was calculated from the relation between drawing 1 (examples 1-2, and 5 of an examination), and drawing 3 (examples 3-4 of an examination). Ef and Em which are shown in the "Note" column of Table 1 are a value in the case of the ideal orientation for obtaining measured value, and are calculated by calculation.
[0017](2) The sound board for an examination with which the quality assessment above-mentioned manufacture of the examples 1-6 of an examination was carried out about the physical properties (density and Young's modulus) of ** textiles. In the state as it is, use a fiber bundle and about the physical properties (density and Young's modulus) of ** matrix material. using the rectangle stick of 3(thickness)x20(width)x150(length)mm -- the frequency characteristic of ** composite, and physical properties (Young's modulus.) About a shear modulus, bending internal friction ($Q_L^{-1}$), and shearing internal friction ($Q_t^{-1}$), it started to the square board of 3(thickness)x150(width)x150(length)mm, and the quality assessment was performed by the following examinations. These results are shown in Tables 1-2 and drawing 1 - 6.
[0018]
[Table 1]

表1

| No. | Sample | Fiber Matrix | $\rho$ g/cm³ | E GPa | VF % | $\rho_t$ g/cm³ | $\rho$ g/cm³ | $E_{Lt}$ GPa | $E_L$ GPa | $E_{RL}$ GPa | $E_R$ GPa | $\Delta E_L/E_{LT}$ % | $\Delta E_R/E_{RT}$ % | $E_L/E_R$ | $E_L/\rho$ | Note |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | CF | 1.81 | 250 | 6.5 | | | | | | | | | | | $E_f$ = 112 |
| 1 | CF-1/FP-1 | | | | | 0.364 | 0.391 | 16.5 | 7.74 | 0.299 | 0.526 | -53.1 | 44.9 | 14.7 | 19.8 | |
| | | FP | 0.264 | 0.277 | 93.5 | | | | | | | | | | | $E_m$ = 0.492 |
| | | CF | 1.81 | 250 | 6.7 | | | | | | | | | | | $E_f$ = 164 |
| 2 | CF-1/FP-2 | | | | | 0.425 | 0.434 | 17.1 | 11.5 | 0.397 | 0.619 | -32.7 | 35.9 | 18.6 | 26.5 | |
| | | FP | 0.326 | 0.374 | 93.3 | | | | | | | | | | | $E_m$ = 0.578 |
| | | CF | 1.81 | 250 | 7.68 | | | | | | | | | | | |
| 3 | CF-1/FP-3 | | | | | 0.440 | 0.440 | 19.6 | 6.28 | 0.405 | 0.633 | -67.9 | 56.3 | 9.9 | 14.3 | |
| | | FP | 0.326 | 0.374 | 92.3 | | | | | | | | | | | |
| | | CF | 1.95 | 227.7 | 6.27 | | | | | | | | | | | |
| 4 | CF-2/FP-4 | | | | | 0.499 | 0.499 | 14.7 | 11.1 | 0.527 | 0.661 | -24.6 | 25.4 | 16.9 | 22.3 | |
| | | FP | 0.402 | 0.494 | 93.7 | | | | | | | | | | | |
| | | GF | 2.38 | 70 | 7.3 | | | | | | | | | | | $E_f$ = 41.1 |
| 5 | GF/FP-5 | | | | | 0.442 | 0.415 | 5.41 | 3.25 | 0.345 | 0.290 | -39.9 | -89.3 | 11.2 | 7.83 | |
| | | FP | 0.289 | 0.32 | 92.7 | | | | | | | | | | | $E_m$ = 0.269 |
| 6 | Sp | | | | | | 0.447 | | 11.6 | | 1.08 | | | 10.8 | 26.1 | |

[0019]
[Table 2]

表2

| No. | Sample | $f_L$ Hz | $Q_L^{-1}$ $\times 10^{-3}$ | $f_R$ Hz | $Q_R^{-1}$ $\times 10^{-3}$ | $E_L/\rho$ | $G_{LR}$ GPa | $E_L/G_{LR}$ |
|---|---|---|---|---|---|---|---|---|
| 3 | CF-1/FP-3 | 1277.8 | 5.01 | 402.4 | 14.4 | 14.3 | 0.943 | 6.66 |
| 4 | CF-2/FP-4 | 1386.5 | 6.49 | 344.0 | 17.2 | 22.3 | 2.68 | 4.16 |
| 6 | Sp | 1481.4 | 9.99 | 451.8 | 18.1 | 26.1 | 1.76 | 6.61 |

[0020]A quality assessment item is shown in Table 1 and 2. Namely, various densities (rho) and Young's modulus (E) of a matrix material which changed the density (rho) of (1) textiles and Young's modulus (E), and (2) expansion ratio, (3) They are the frequency characteristic of composite, Young's modulus (E), a shear modulus (G), bending internal friction ($Q_L^{-1}$), and shearing internal friction ($Q_t^{-1}$). The calculated value according [ according to / in "L" of a subscript / a grain direction / textiles, direction crossing at a right angle, and "t" ] to the rule of mixture in "R" is shown, respectively. "rho" of textiles used the Archimedes method, "E" used LEO Vibron (made by a cage ene tech company), and it measured. A "frequency characteristic" installs four corners horizontally on nylon yarn so that the sample plate circumference may become free, The forcible drive of the piece of Kotetsu stuck on the central undersurface was carried out by the sine wave with a frequency of 0.1-10 kHz by electromagnetism ******, and it measured by detecting the amplitude of the response vibration in each frequency with the microphone installed in 2 mm of central upper parts. "Dynamic Young's modulus E" of a sample plate and the "shear modulus G" asked for resonance frequency $f_0$ (Hz) from the response curve obtained by the deflection and return forced oscillation method of both-ends freedom, and asked for it from the following formula.
[0021]
[Equation 1]

$$E = \frac{48\pi^2 \rho l^4 f_0^2}{m^4 t^2}$$

$$G_{LR} = \frac{\rho(1+u^2)l^2 f_0^2}{g(u)}$$

$$u = \frac{w}{t}\cdot\left(\frac{G_{LR}}{G_{TR}}\right)^{1/2}, g(u) \approx 1 - \frac{192}{\pi^5}\cdot\frac{1}{u}\cdot\tanh\frac{\pi}{2}u$$

[0022]Here, "rho" is 4.730 in a both-ends free fundamental oscillation by density and the constant to which the direction length of sample plate L and "w" are dependent on the direction length of sample plate R, "t" is dependent on sample plate thickness, and "l" depends for "m" on the mode of vibration. Internal-friction $Q^{-1}$ was calculated from the following formula which asked for half-peak-width **f from the response curve.

[0023]

[Equation 2]

$$Q^{-1} = \frac{\Delta f}{f_0}$$

[0024](3) Effect **** of an example and the relation between rho and E (and G) are shown in drawing 1 and drawing 3. As shown in these figures, straight-line relations were obtained by correlation that both are high. The composite material design was performed using this and a textiles physical-properties measurement result. The ratio of difference of calculated value [ of Table 1 ] and actual measurement, i.e., **$E_L/E_{LT}$, and **$E_R/E_{RT}$ is considered that are as large as about 50 to 90%, and distribution of textiles is not fully performed in the examples 1, 3, and 5 of an examination. On the other hand, since that ratio is comparatively as small as about 25 to 36%, the examples 2 and 4 of an examination are considered that textiles are distributing it comparatively well although this specimen is not enough. In the case of the examples 1, 2, and 5 of an examination, $E_f$ in the case of the ideal orientation for obtaining measured value and an $E_m$ value were calculated by calculation, and it was shown in the Note column of Table 1. These show what the one-directional orientation and uniform dispersion of textiles have not said well enough.

[0025]As mentioned above, although a dispersed degree of textiles changes with each examples of an examination, the following things can be said from a result of Tables 1 and 2. Namely, although the example 5 (No.5 is said.) of an examination is using glass fiber, and is small enough in a similar manner compared with Sp as a comparison article and the degree of different direction ($E_L/E_R$) is also comparable as Sp, [ of rho ] $E_L$ is as small as 3.25, moreover EL/rho is also as small as 7.83, and sufficient sound performance has not come out. Although rho and the degree of anisotropy are fully excellent in the example 1 of an examination and it is only slightly small compared with Sp as a comparison article, sufficient sound performance has not come out [ in / $E_L$ is as small as 7.74 and / this point ]. [ of EL/rho ]

[0026]Although rho and the degree of different direction are fully excellent compared

with Sp as a comparison article, since $E_L$ is as small as 6.28 and EL/rho is also as small as 14.3, sufficient sound performance has not come out of the example 3 of an examination in this point. However, $Q_L^{-1}$ which influences a transient characteristic is smaller than a case ($9.99 \times 10^{-3}$) of $5.01 \times 10^{-3}$ and Sp, and the outstanding performance is shown. Since it is equivalent to Sp, in a frequency characteristic, depression of a level in a high region of $E_L/G_{LR}$ is comparable. This is because it will be greatly influenced by shear strain in vibration of higher mode and depression of a level in a high region will become large, if $E_L/G_{LR}$ is large. A frequency response characteristic result of an one-third octave hand by tapping is shown in drawing 4 and 6 about the example 3 of an examination, and Sp. This Map is used for backing of a violin and the characteristic contrary to a front board is called for. The frequency characteristic of Sp in this drawing 6 has wide width of the 1st and the 2nd peak which shows resonance frequency in each dominant mode of the direction of R, and the direction of L, and a large thing of depression of a power level in a wide area from near 1 kHz is raised as a feature. Although both peaks are low and have shifted to the whole greatly from Sp in composite of the example 3 of an examination low-pass, width of the peak is comparable. Reduction of a level in a high region is a little smaller than Sp. And composite of the example 3 of an examination is shifted a little lowness from Sp in 300-400 Hertz and 6000 Hertz, In 1000-2000 Hertz, the peak as Sp of a certain thing in which two peaks are almost the same is shown, a peak spectrum similar as a whole is shown, and a possibility high as an alternate material of soundboard timber material is shown.

[0027]Although the example 4 of an examination has rho as larger as 0.499 (Sp:0.447) compared with Sp as a comparison article, other performances, i.e., $E_L$, are almost equivalent, the degree of different direction (16.9, Sp=10.8) is more excellent, and its EL/rho is also almost equivalent to 22.3 (Sp:26.1). $Q_L^{-1}$ shows a value smaller than a case ($9.99 \times 10^{-3}$) of $6.49 \times 10^{-3}$ and Sp, and shows the outstanding performance. $E_L/G_{LR}$ is smaller than Sp and depression of a level in a high region is small. A frequency response characteristic result of an one-third octave hand by tapping is shown in drawing 5 and 6 about the example 4 of an examination, and Sp. According to this result, composite of the example 4 of an examination is shifted a little lowness from Sp in 300-400 Hertz and 6000 Hertz, In 1000-2000 Hertz, the peak as Sp of a certain thing in which two peaks are almost the same was shown, a peak spectrum similar as a whole was shown, and a possibility high as an alternate material of soundboard timber material was shown. As mentioned above, with Sp material which shows outstanding performance, the performance which is not is shown, performance which is more excellent rather also occurs, and inferiority can almost use an example article of an exam fully as an alternate material of Sp material as a whole.

[0028]Compared with Sp as a comparison article, rho the example 2 of an examination 0.434 (Sp:0.447), 11.5 (Sp:11.6) and the degree of anisotropy are [ 18.6 (Sp=10.8) and EL/rho ] 26.5 (Sp:26.1), and $E_L$ shows the almost the same and rather more desirable performance. A frequency response characteristic result of an one-third octave hand by tapping is shown in drawing 2 about the example 2 of an examination, Sp, and Map. According to this result, composite of the example 2 of an examination shows the characteristic which shifted Sp to a high region on the level mostly, and shows a possibility high as an alternate material of soundboard timber material. Also in the above-mentioned examples 1, 3, and 4 of an examination, if distribution of textiles is made more

into homogeneity, a possibility that the example 2 of an examination, i.e., Sp and an equivalent grade, and performance beyond it will come out will also fully be considered to be a certain thing.

[0029]As mentioned above, according to the above-mentioned composite, rho shall be certainly provided with the outstanding performance [ / 0.385-0.469 $g/cm^3$ and / $E_{L//}$ 10.1 - 14.9Mpa and / QL -1] demanded 5.4 - 7.2x10-3. For a product made of resin which replaces wooden Sp material which is very excellent as a soundboard of a musical instrument, influence is not received in humidity and a thing of stable quality can be manufactured easily and certainly. Obtaining composite provided with sound effects outstanding further further is also fully considered by planning uniform dispersion of much more textiles.

[0030]

[Effect of the Invention]the high ratio which the composite for sound boards and the sound board of this invention need for sound boards, such as musical instrument soundboard material, -- it has Young's modulus, a low extinction ratio, and strong anisotropy, and is not influenced by humidity, the tone of the always stable musical instrument is obtained, and it excels extremely as a wood alternate material. If the composite of this invention is used for the front board of a stringed instrument, the soundboard of a piano, etc., the large simplification of a material control and a manufacturing process and highly-precise-izing of material quality are possible. This invention is widely used for the front board of a violin group musical instrument, the front board of a guitar, the soundboard of a piano, etc.

[Claim(s)]

[Claim 1]Composite for sound boards characterized by comprising the following.
A resin matrix which has an opening.
Carbon fiber by which was allocated into this resin matrix and orientation was carried out to one way.

[Claim 2]The composite for sound boards according to claim 1 whose ratios ($E_L/G_{LR}$) of Young's modulus $E_L$ and shear-modulus $G_{LR}$ density is 0.38-0.52$g/cm^3$, Young's modulus $E_L$ of a grain direction is 9 - 15GPa, and are 5.0-7.0.

[Claim 3]an $E_L$/rho ratio -- internal-friction $Q_L^{-1}$ of 18-30, and a grain direction -- 4 - $10x10^{-3}$ and $E_L/E_R$ (Young's modulus of a grain direction and a direction which goes direct) -- 9-20 -- the composite for sound boards according to claim 2.

[Claim 4]The composite for sound boards according to any one of claims 1 to 3 which equips at least 200-500 Hertz, 1000-2000 Hertz, and 5000-7000 Hertz with each peak in a frequency response characteristic figure of 1/3 octave band by tapping.

[Claim 5]A sound board comprising:
A resin matrix which has an opening.
Carbon fiber by which was allocated into this resin matrix and orientation was carried out to one way.

[Claim 6]The sound board according to claim 5 whose ratios ($E_L/G_{LR}$) of Young's modulus $E_L$ and shear-modulus $G_{LR}$ density is 0.38-0.52$g/cm^3$, Young's modulus $E_L$ of a

grain direction is 9 - 15GPa, and are 5.0-7.0.
[Claim 7]an $E_L$/rho ratio -- internal-friction $Q_L^{-1}$ of 18-30, and a grain direction -- 4 - $10x10^{-3}$ and $E_L/E_R$ (Young's modulus of a grain direction and a direction which goes direct) -- 9-20 -- the sound board according to claim 6.
[Claim 8]The sound board according to any one of claims 5 to 7 which equips at least 200-500 Hertz, 1000-2000 Hertz, and 5000-7000 Hertz with each peak in a frequency response characteristic figure of 1/3 octave band by tapping.

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WPI Acc no: 2000-618689/200059
Related WPI Acc No: 2003-845182
XRAM Acc no: C2000-185225
XRPX Acc No: N2000-458525
**Data storage media e.g. magnetic disk used in magnetic system, includes data layer formed on substrate consisting of plastic resin portion**
Patent Assignee: BUSHKO W C (BUSH-I); COLE H S (COLE-I); DAI K H (DAIK-I); DAL K H (DALK-I); DAL KEVIN H (DKEV-I); DAVIS J E (DAVI-I); FEIST T P (FEIS-I); FURLANO D (FURL-I); GENERAL ELECTRIC CO (GENE); GORCZYCA T B (GORC-I); HARIHARAN R (HARI-I); KUBOTERA K (KUBO-I); LANDA B P (LAND-I); LIKIBI P J M (LIKI-I); MERFELD G D (MERF-I); SUBRAMANIAN S (SUBR-I); WOODS J T (WOOD-I)
Inventor: BUSHKO W C; COLE H S; DAI K H; DAL K H; DAL KEVIN H; DAVIS J E; FEIST T P; FURLANO D; GORCZYCA T B; HARIHARAN R; KUBOTERA K; LANDA B P; LIKIBI P J M ; MERFELD G D; SUBRAMANIAN S; WOODS J; WOODS J T; DAVIS J; LANDA B

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NOVELTY - The storage media includes a data layer formed on a substrate consisting of a plastic resin portion. The data layer can be partly read from or/and written to, when an energy field is incident on data layer, before it can be incident upon the substrate. DESCRIPTION - The substrate has an area density greater than 10 Gbits/in $^2$ or 25 Gbits/in $^2$ and an edge lift height of less than about 3 microns. The substrate has a surface roughness of less than about 10 AngstromsRa, and a mechanical **damping** coefficient of greater than about 0.04 or 0.06 at a temperature of 24 (deg)C. The substrate has a moment of inertia of not more than $5.5 \times 10^{-3}$ slug-in $^2$ and has a radial tilt and tangential tilt independently of about 1(deg) each. The moisture content of the substrate varies less than 0.5% at equilibrium under test conditions of 80 (deg)C at 85% relative humidity after 4 weeks. The substrate has a specific gravity of less than 1.0 and an axial displacement peak of less than 500 microns under shock or vibration excitation and a normal axial displacement peak of less than 150 microns. The substrate has a resonant frequency of greater than 250 **Hz**. The substrate consists of one among amorphous, crystalline or semi-crystalline material, a composite or blend or combination or metal like aluminum. The substrate consists of metal core with a plastic film disposed on a portion of one side of the core. The substrate includes a material selected from the group of metal, glass, ceramic and reinforcement which includes fibers, whiskers, fibrils, particulate, nanotubes, metal, mineral, plastic, ceramic and glass. The substrate has a thickness which is either a constant or variable. The substrate has a thickness geometry which is either concave. The substrate has an outer diameter and a core whose thickness can be constant or varied. The core has a geometry which is concave, convex, tapered radial arm, star like. The outer diameter of the core is equal to the outer diameter of the substrate. The core has a hollow or filled cavity, and multiple portions consisting of different materials. The core is formed in situ** with the substrate. The substrate includes an insert which consists of several portions attached to the substrate on a surface of substrate opposite to the data layer. The insert consists of single element having uniform thickness. The substrate has a first model frequency greater than the operating frequency and a second operating frequency less than the first model frequency. The plastic resin film disposed on the portion of the core in the substrate has a thickness of about 50 microns 20 microns. The energy field incident on the data layer is one of the electric field, magnetic field and optical field. The storage media has surface features selected from one among pits, grooves, edge features, asperities and has a replication of greater than about 90% replication of original master. The substrate has **Young**'s **modulus** of 7 **GPa** or 70 **GPa**, 200 **GPa**. The storage media has a data layer with a coercivity of 3000 oersted or 1500 oersted. The elastic film on the substrate which is either spin coated, spray coated or spin and spray coated plastic film, consists of a thermoplastic resin with a glass transition temperature of 140 (deg)C. The head slap characteristics of the storage media containing the plastic film is equivalent to the storage media not containing plastic film. The plastic film consists of thermoset resin consisting of embossed surface features.

INDEPENDENT CLAIMS are also included for: (i) substrate manufacturing method which involves selecting a method from among a group consisting of injection molding, foaming processes, injection compression, sputtering, plasma vapor deposition, vacuum deposition, electro deposition, spin coating, spray coating, meniscus coating, data stamping, embossing, surface polishing, fixturing, laminating, rotary molding, two shot molding, micro cellular molding. Either injection molding or injection molding-compression molding is preferred. The substrate is produced with desired pits and grooves, having greater than 90% of the pit and groove replication of original master; (ii) data retrieving method which involves rotating the storage media at a variable speed and directing an energy field through the data layer. Energy field is reflected back through the data layer. The substrate has flexural modulus of 250 KPSi and specific gravity that places the first model frequency outside the operating frequency; (iii) substrate embossing method which involves heating the substrate to a temperature of about 30 (deg)C above the glass transistor temperature and introducing heated substrate to a preheated mold. The substrate is then compressed in the mold, cooled and removed from the mold. The substrate having roughness and elastic portion on its surface, includes imprint of desired surface feature into the plastic while compressing. The mold is cooled below the glass transition temperature and the mold temperature is 20 (deg)C or 5 (deg)C above the glass transition temperature. The mold temperature is maintained within 30 (deg)C of glass transition material.
USE - For example as optical, magnetic, magneto-optic media such as compact disk, read only memory, rewritable compact disks, digital video disks used in magneto-optic, magnetic and optic systems
ADVANTAGE - Provides storage media that has reduced axial displacement when excited by environmental at rotational vibrations, greater surface quality denoted by fewer irregularities and lower rotating moment of inertia, thus preventing damage to the read/write device. Avoids mechanical decay, since the substrate has sufficient yield stress. Enables manipulation of moment of inertia of the substrate when rotating and control of model responses by adjusting the geometry of the substrate. Prevents deformation during deposition steps, since the plastic material has sufficient thermal stability. Reduces embossing cycle time by maintaining the mold below the glass transition temperature.
DESCRIPTION OF DRAWINGS - The figure shows the cross-sectional view of read/write system.
**Alerting Abstract** ... an edge lift height of less than about 3 microns. The substrate has a surface roughness of less than about 10 AngstromsRa, and a mechanical **damping** coefficient of greater than about 0.04 or 0.06 at a temperature of 24 (deg)C. The substrate has a moment of inertia of... ... shock or vibration excitation and a normal axial displacement peak of less than 150 microns. The substrate has a resonant frequency of greater than 250 **Hz**. The substrate consists of one among amorphous, crystalline or semi-crystalline material, a composite or blend or combination or metal like aluminum. The substrate consists... ... selected from one among pits, grooves, edge features, asperities and has a replication of greater than about 90% replication of original master. The substrate has **Young's modulus** of 7 **GPa** or 70 **GPa**, 200 **GPa**. The storage media has a data layer with a coercivity of 3000 oersted or 1500 oersted. The elastic film on the substrate which is either...

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Dialog eLink: Order File History
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0006198292
WPI Acc no: 1992-180202/199222
XRAM Acc no: C1992-082559
XRPX Acc No: N1992-135936

**Core resin for cpd. type damping metal plate - comprises silicon cpd. with specific Young's modulus, dispersed in viscoelastic, pref. isocyanate crosslinked polyester copolymer resin**

Patent Assignee: KAWASAKI STEEL CORP (KAWI)
Inventor: EGUCHI K; SUGIBE H; UCHIDA Y; WAKUI M

| Patent Family ( 1 patents, 1 countries ) | | | | | | | |
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Priority Applications (no., kind, date): JP 1990238260 A 19900907

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| JP 4117463 | A | JA | 20 | 0 | |


**Alerting Abstract** JP A
The resin comprises (B) a material having up to 1 x 10 power(7) **dyne /cm2** of **Youngs modulus** at -50 to 100 deg.C, dispersed in (A) a viscoelastic resin.
(A) pref. has glass transition point at -50 to 100 deg.C and at least 0.5 of the max. of tan-delta at 0.1-20,000 **Hz** of frequency. (A) is pref. a satd. polyester copolymer crosslinked by an isocyanate cpd.; (B) pref. has a b.pt. of at least 200 deg.C. (B) is pref. a silicon cpd.. The longest dia. of particles of (B) is 0.1-100 microns and may be microcapsulated particles. 1-50 Vol.% of (B) is contained in the core resin.
USE/ADVANTAGE - The **damping** plate shows good **damping** property at wide temp. range and wide frequency range with other satisfied properties required.


**Core resin for cpd. type damping metal plate... ...comprises silicon cpd. with specific Young's modulus, dispersed in viscoelastic, pref. isocyanate crosslinked polyester copolymer resin Original Titles:**CORE RESIN FOR COMPOSITE VIBRATION-**DAMPING** METAL PLATE, COMPOSITE VIBRATION-**DAMPING** METAL

PLATE USING THE SAME, AND ITS PRODUCTION **Alerting Abstract** ...The resin comprises (B) a material having up to 1 x 10 power(7) **dyne/cm2** of **Youngs modulus** at -50 to 100 deg.C, dispersed in (A) a viscoelastic resin... ...glass transition point at -50 to 100 deg.C and at least 0.5 of the max. of tan-delta at 0.1-20,000 **Hz** of frequency. (A) is pref. a satd. polyester copolymer crosslinked by an isocyanate cpd.; (B) pref. has a b.pt. of at least 200 deg... ...USE/ADVANTAGE - The **damping** plate shows good **damping** property at wide temp. range and wide frequency range with other satisfied properties required.

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**Dialog eLink:** Order File History
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DIALOG(R)File 350: Derwent WPIX
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0003538453
WPI Acc no: 1985-318266/198551
XRAM Acc no: C1985-137431
**Vibration-damping thermoplastic polymer compsn. - contg. both amorphous resins such as vinyl ester(s) styrene of acrylic copolymer(s) and crystalline resins such as polyethylene or polypropylene**
Patent Assignee: MITSUBISHI PETROCHEMICAL CO LTD (MITP); NIPPON KOKAN KK (NIKN); NKK CORP (NIKN)
Inventor: HORIE S; ITSUBO A; OCHIUMI M; SEKIZUKA N; WATANABE Y

Patent Family ( 11 patents, 10 countries )

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| KR 199000972 | B | 19900223 | | | | 199101 | E |
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| DE 3587555 | G | 19931007 | DE 3587555 | A | 19850611 | 199341 | E |

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|---|---|---|---|---|---|---|---|
| | | | EP 1985107194 | A | 19850611 | | |
| JP 1994072634 | B2 | 19940914 | JP 1984183121 | A | 19840901 | 199435 | E |

**Alerting Abstract** EP A
Vibration-**damping** resin compsn. contg. (A) thermoplastic polymers which are (1) 10-95 (pref. 30-80) wt.% amorphous and (b) 90-5 (pref. 70-20) wt.% crystalline, incompatible with (a). (a) having a glass transition temp. lower than that of (b) and a max. at least 0.5 (pref. 1.0) within a temp. range of -50 to 150 deg. C, and a frequency range of 0.1-20,000H2. (b) having a m.pt. 30 (pref. 50) deg. C higher than the glass transition temp. of (a). and a sheer storage modulus at least 1x10 power 8 **dyne /cm2** (pref. 6x10 power 8) at the temp. and frequency at which (a) exhibits max. tand. (B) 5-90 wt.% (a) and 95-10 wt.% (b) and at least one of the monomers in (a) being copolymerised with (b) in at least 0.5 (pref. 3) wt.% of (a).
Pref. (a) is a vinyl ester, styrene or acrylic (co)polymer and can be an acrylic ester (I), and an aryl vinyl monomer (II), or vinyl latex (co)polymer, polyvinyl butyral, styrene (co)polymer, thermoplastic rubber, halocarbon plastic, acrylic (co)polymers. (I) is pref. n-butyl, 2 ethyl hexyl, linevol, isononyl 2 butoxyethyl, or diethylene glycol monobutyl ether, acrylate, lauryl and tridecyl methacrylate. (II) is pref. styrene, 4 methyl styrene and alpha methyl styrene. (b) is an ethylene or propylene polymer, and can be crystalline alpha olefin resins and condensation polymers, high density polyethylene and higher alpha olefin polymers than poly-propylene.
USE - Vibration dampings in engine covers, or any metal surrounding a source of noise for the sake of environmental hygiene.

**Vibration-damping thermoplastic polymer compsn...** ...**Original Titles:**Vibration-**damping** resin composition... ...Vibration-**damping** laminate... ...RESIN COMPOSITION FOR VIBRATION **DAMPING** ... ...VIBRATION-**DAMPING** RESIN COMPOSITION... ...Vibration-**damping** composite metal plate **Alerting Abstract** ...Vibration-**damping** resin compsn. contg. (A) thermoplastic polymers which are (1) 10-95 (pref. 30-80) wt.% amorphous and (b) 90-5 (pref. 70-20) wt.% crystalline... ...m.pt. 30 (pref. 50) deg. C higher than the glass transition temp. of (a). and a sheer storage modulus at least 1x10 power 8 **dyne/ cm2** (pref. 6x10 power 8) at the temp. and frequency at which (a) exhibits max. tand. (B) 5-90 wt.% (a) and 95-10 wt.% (b... **Equivalent Alerting Abstract** ...A vibration-**damping** composite metal plate comprising two metal plates and a resin compsn. (I) sandwiched therebetween. (I) consists of 20-70 wt.% of an amorphous thermoplastic polymer... ...alpha-olefin resin or condensation polymer having a sheat storage modulus of over 1 x 10 power 8, pref. over 6 x 10 power 8 **dyne**/sq. **cm**. and is pref. a propylene polymer... **Technology Focus** Original Publication Data by AuthorityArgentina**Publication No. Original Abstracts:**Vibration-**damping** resin composition.
A vibration-**damping** resin composition of the invention comprises 10 to 95% by weight

of an amorphous thermoplastic resin polymer (a) and 90 to 5% by weight of... ... a predetermined temperature and frequency range. The polymer (b) has a melting point higher than the glass transition temperature of the polymer (a) and a **shear** storage **modulus** of 1 x 108 **dyne/cm2** or more at the temperature and frequency at which the polymer (a) exhibits the maximum tandelta... ... A vibration-**damping** resin composition of the invention comprises 10 to 95% by weight of an amorphous thermoplastic resin polymer (a) and 90 to 5% by weight of... ... a predetermined temperature and frequency range. The polymer (b) has a melting point higher than the glass transition temperature of the polymer (a) and a **shear** storage **modulus** of 1x108 **dyne/cm2** or more at the temperature and frequency at which the polymer (a) exhibits the maximum tandelta. **Claims:** Vibration-**damping** resin compsn. contg. (A) thermoplastic polymers which are (1) 10-95 (pref. 30-80) wt.% amorphous and (b) 90-5 (pref. 70-20) wt.% crystalline... ... m.pt. 30 (pref. 50) deg. C higher than the glass transition temp. of (a). and a sheer storage modulus at least 1x10 power 8 **dyne/cm2** (pref. 6x10 power 8) at the temp. and frequency at which (a) exhibits max. tand. (B) 5-90 wt.% (a) and 95-10 wt.% (b... ... delta von nicht weniger als 0,5 bei einem Temperaturbereich von -50 bis 150 (deg)C und einem Frequenzbereich von 0,1 bis 20 000 **Hz** besitzt, und wobei es sich bei dem Polymer (b) um ein Element handelt, das ausgewaehlt ist aus der Gruppe, die aus kristallinen alpha-Olefinharzen und... ... 1. A vibration-**damping** composite metal plate comprising two metal plates and a resin composition sandwiched between the metal plates, the resin composition consisting essentially of 20 to 70... ... not less than 0,5 with a temperature range of -50 to 150 (deg)C and a frequency range of 0,1 to 20 000 **Hz**, and the polymer (b) being one member selected from the group consisting of crystalline alpha-olefin resins and crystalline condensation polymers, and having a melting point higher than the glass transition temperature of the polymer (a) and a **shear** storage **modulus** not less than 1 x 103 N/cm2 (1 x 108 **dyne/cm2**) at the temperature and frequency at which the polymer (a) exhibits the maximum tan delta.

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**NON PATENT LITERATURE BIBLIOGRAPHIC DATABASES:**

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------------------------------------------------------------------------------
Set      Items    Description
S1      698017    DAMPING OR DAMPED OR DAMPER? ?
S2       95666    (VIBRAT? OR WOBBL? OR BEND? OR FLEXUR? OR SWAY? OR
TWIST? -
             OR TORSION? OR TORQU? OR OSCILLAT? OR NUTAT? OR PALPITAT?
OR -
             SHIMM? OR TREMOR? OR QUIVER? OR FLEX? OR DEFLEC? OR
DEFLEX? OR
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OR
             STOP? ? OR STOPP? OR ABSORB?)
S3      103551    (VIBRAT? OR WOBBL? OR BEND? OR FLEXUR? OR SWAY? OR
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DEFLEX? OR
              RESONAN?()FREQUENC?)(3N)(HALT? OR ARREST? OR LIMIT? OR
RESTR-
             ICT? OR RETARD? OR RESTRAIN?)
S4      183871    (VIBRAT? OR WOBBL? OR BEND? OR FLEXUR? OR SWAY? OR
TWIST? -
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OR -
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DEFLEX? OR
              RESONAN?()FREQUENC?)(3N)(CONSTRAIN? OR IMPED? OR HINDER?
OR -
             CURB? OR PREMPT? OR DETER? OR AVOID?)
S5       50673    (VIBRAT? OR WOBBL? OR BEND? OR FLEXUR? OR SWAY? OR
TWIST? -
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OR -
             SHIMM? OR TREMOR? OR QUIVER? OR FLEX? OR DEFLEC? OR
DEFLEX? OR
              RESONAN?()FREQUENC?)(3N)(PRECLU? OR INHIBIT? OR SUBDU? OR
OF-
             FSET? OR MINIMI? OR COUNTERACT? OR ALLEVIAT?)
S6       73503    (VIBRAT? OR WOBBL? OR BEND? OR FLEXUR? OR SWAY? OR
TWIST? -
             OR TORSION? OR TORQU? OR OSCILLAT? OR NUTAT? OR PALPITAT?
OR -
             SHIMM? OR TREMOR? OR QUIVER? OR FLEX? OR DEFLEC? OR
DEFLEX? OR
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OR -
             CURTAIL? OR ATTENUAT? OR BRAKE? OR BRAKING OR DAMPEN?)
S7     1133145    S1:S6
S8       13801    (MODULUS OR MODULI)(2N)ELASTIC?
S9       24350    (ELASTIC??? OR YOUNG? ? OR VISCOELAST?)(2N)(MODULI OR
MODU-
             LUS OR COEFFICIENT? ? OR CO()EFFICIENT? ? OR DEFORMAT?)
S10        424    (TENSILE(2N)STRESS)(5N)(TENSILE(2N)STRAIN)
S11       9246    (MODULUS OR MODULI)(2N)(BULK OR SHEAR OR PWAVE OR
P()WAVE)
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            OR POISSON?(2N)RATIO OR LAME?(2N)PARAMET?
S12       1630   GIGAPASCAL? OR GIGA()PASCAL? OR GPA OR GPAS
S13         10   KILOBAR? OR KILO()(BAR OR BARS)
S14        216   MEGAPASCAL? OR KILOPASCAL? OR HECTOPASCAL? OR (MEGA OR
KILO
             OR HECTO)()PASCAL? OR HPA OR HPAS
S15       1048   TORR OR TORRS OR MILLIBAR?
S16       1602   KB OR MB OR KBS OR MBS OR DYNE? ?(2N)(CM OR CM2 OR CMS
OR -
            CMS2 OR CENTIMET? OR SQUAREDCENTIMET? OR SQCENTIMET? OR
SQUAR-
            ECENTIMET?)
S17      21754   HERTZ OR HZ
S18      15041   MEGAHERTZ? OR MHZ OR KILOHERTZ? OR KHZ
S19     430259   TWO OR SECOND? OR 2ND OR BOTH OR PAIR OR TWIN OR TANDEM
OR
            TWOSOME OR TWOFOLD OR DOUBLE? OR DUPLE? OR TUPLE?
S20          0   AU=(SASSINE J? OR SASSINE H? OR SASSINE JH OR SASSINE
HJ)
S21          0   AU=(SASSINE, J? OR SASSINE, H? OR SASSINE, JH OR
SASSINE, -
            HJ)
S22         95   AU=(BHATTACHARYA S? OR BHATTACHARYA, S?)
S23          2   AU=(HUTCHINSON A? OR HUTCHINSON AJ OR HUTCHINSON, A? OR
HU-
            TCHINSON, AJ)
S24          1   AU=(LIMMER J? OR LIMMER JD OR LIMMER, J? OR LIMMER, JD)
S25          0   SASSINE(2N)(JOE OR JOSEPH) OR BHATTACHARYA(2N)SAND? OR
HUT-
            CHINSON(2N)(ANDREW OR ANDY) OR LIMMER(2N)JOEL?
S26        497   (STRUCTUR? OR HINGE? OR GIMBAL? OR BEAM? ?)(20N)(HDD OR
DI-
            SC()DRIVE? OR DISK()DRIVE? OR DIS?DRIV? OR HARDDRIV? OR
HARD(-
            )DRIV?)
S27        417   HEAD()SUSPENSION? OR ACTUATOR(2N)(ARM OR ARMS)
S28       1419   HEAD()(SLIDER? OR GIMBAL? OR STACK? OR BEAM? ? OR
HINGE?) -
             OR MAGNET?()(SLIDER? OR DRIVE? OR HEAD? ?)
S29        252   IC=(G11B? OR G06F? OR C08J? OR F16F?)
S30          0   MC=(T03? OR A05? OR A88? OR A05? OR A12? OR A18? OR
A28? OR
             P73? OR Q63?)
S31         98   S20:S25
S32          3   S23:S24
S33          3   RD  (unique items)
S34         95   S31 NOT S32
S35         49   S34 AND PY=1970:2004
S36         59   S34 NOT PY=2005:2009
S37         59   S35:S36
S38         33   RD  (unique items)
S39    1133047   S7 NOT S31
S40        133   S39 AND S8:S11 AND S12:S16 AND S17:S18
S41         47   S40 AND (S19 OR S26:S30)
S42         20   RD  (unique items)
S43         86   S40 NOT S41
S44         57   S43 AND PY=1970:2004
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S45         57   S43 NOT PY=2005:2009
S46         57   S44:S45
S47         19   RD  (unique items)
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**Dialog eLink:** USPTO Full Text Retrieval Options
38/5,K/15 (Item 1 from file: 14)
DIALOG(R)File 14: Mechanical and Transport Engineer Abstract
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0004076883 IP Accession No: 200909-61-1263802
**Head suspension with vibration damping for a data storage device**

Renken, Frederick Paul; Hammel, Brian Dean; Narayan, Shri Hari; McReynolds, Dave Paul; **Bhattacharya, Sandeepan**
, USA
**Publisher Url:** http://patft.uspto.gov/netacgi/nph-Parser?Sect1=PTO2&Sect2=HITOFF&u =/netaht ml/PTO/search-adv.htm&r=1&p=1&f=G&l=50&d=PTXT&S1=75 51400.PN.&OS=pn/7551400& RS=PN/7551400

**Document Type:** Patent
**Record Type:** Abstract

**Language:** English
**File Segment:** Mechanical & Transportation Engineering Abstracts

**Abstract:**
An apparatus, method and combination for dissipating vibration from a head suspension of a data storage device. The combination includes a rotating disc in a data exchange relationship with a read/write head supported by a head suspension formed by the method. The method includes the steps of; forming a mounting region and a load beam region each adjacent a bend region; removing material from the bend region to form an aperture, a strut, an isolation aperture and a damping material support structure; and affixing a damping material to the strut and the damping material support structure. The apparatus includes the bend region adjacent both the mounting region and the load beam region, with the damping material attached to the strut as well as to the damping material support structure. The load beam region includes a rigid portion, which supports a flexure upon which a read/write head is attached.

**Descriptors:** Beams (structural); Damping; Supports; Struts; Data storage; Mounting; Devices; Apertures; Flexing; Vibration; Discs; Dissipation; Disks; Rotating ; Vibration damping; Forming; Data exchange
**Subj Catg:** 61, Design Principles
Renken, Frederick Paul; Hammel, Brian Dean; Narayan, Shri Hari; McReynolds, Dave Paul; **Bhattacharya, Sandeepan**

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**Dialog eLink:** USPTO Full Text Retrieval Options
42/5,K/11 (Item 1 from file: 23)
DIALOG(R)File 23: CSA Technology Research Database
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0002945118 IP Accession No: A86-27315
**Young's modulus and damping capacity of Ti-6Al-4V**

LEE, Y T; WELSCH, G Case Western Reserve University, Cleveland, OH [LEE]
**Pages:** 1689-1696
**Publication Date:** 1985
**Publisher:** Oberursel, West Germany, Deutsche Gesellschaft fuer Metallkunde

**Conference:**
Titanium: Science and technology; Proceedings of the Fifth International Conference on Titanium, Munich, West Germany , GERMANY, FEDERAL REPUBLIC OF , 10-14 Sept. 1984

**Document Type:** Conference Paper
**Record Type:** Abstract
**Language:** ENGLISH
**Numbers:** Contract: NSF DMR-81-21772; A86-27201 11-26
**Notes:** Volume 3
**No. Of Refs.:** 25
**File Segment:** Aerospace & High Technology

**Abstract:**
Dynamic **Young**'s **modulus** and **damping** coefficients were measured in texture- free Ti-6Al-4V alloy as a function of solution heat-treatment, aging treatment, and oxygen concentration. The resonance bar method was used at 66 **kHz** and at low strain amplitude of less than 0.00001. Several phases (alpha, beta, alpha-prime, and alpha- **double**-prime) can be obtained by the heat-treatments. **Young's modulus** depends upon the volume fractions of these phases as well as on their individual moduli. Depending on heat- treatment and oxygen concentration, **Young**'s **modulus** ranges from 108 to 118 **GPa** with **damping** coefficients ranging from 0.0015 to less than 0.0001. The 800 C solution-treated and quenched condition exhibits the lowest modulus and highest **damping** capacity. This is attributed to soft metastable beta or alpha-**double**-prime martensite phase, respectively. Aging treatments increase **Young**'s **modulus** and decrease the **damping** capacity. Oxygen increases **Young**'s **modulus** but has little effect on the **damping** capacity. (Author)

**Descriptors**: *Aluminum alloys; ***Modulus** of **elasticity**; *Titanium alloys; *Vanadium alloys; *Vibration **damping**; Aging (metallurgy); Chemical composition; Electron microscopy; Microstructure; Oxygen; Quenching (cooling)
**Subj Catg**: 26, METALLIC MATERIALS
**Young's modulus and damping capacity of Ti-6Al-4V**

**Abstract:**
Dynamic **Young**'s **modulus** and **damping** coefficients were measured in texture- free Ti-6Al-4V alloy as a function of solution heat-treatment, aging treatment, and oxygen concentration. The resonance bar method was used at 66 **kHz** and at low strain amplitude of less than 0.00001. Several phases (alpha, beta, alpha-prime, and alpha- **double**-prime) can be obtained by the heat-treatments. **Young's modulus** depends upon the volume fractions of these phases as well as on their individual moduli. Depending on heat- treatment and oxygen concentration, **Young**'s **modulus** ranges from 108 to 118 **GPa** with **damping** coefficients ranging from 0.0015 to less than 0.0001. The 800 C solution-treated and quenched condition exhibits the lowest modulus and highest **damping** capacity. This is attributed to soft metastable beta or alpha-**double**-prime martensite phase, respectively. Aging treatments increase **Young**'s **modulus** and decrease the **damping** capacity. Oxygen increases **Young**'s **modulus** but has little effect on the **damping** capacity. (Author)

**Descriptors**: *Aluminum alloys; ***Modulus** of **elasticity**; *Titanium alloys; *Vanadium alloys; *Vibration **damping**; Aging (metallurgy); Chemical composition; Electron microscopy; Microstructure; Oxygen; Quenching (cooling)
**Identifiers:**

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47/5,K/5 (Item 5 from file: 2)
DIALOG(R)File 2: INSPEC
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04145217

**Title:** **Internal friction and dynamic modulus of metal matrix composites and advanced alloys**
**Author(s):** Wolfenden, A.; Frisby, C.K.; Heritage, K.J.; Vinson, S.S.; Knight, R.C.
**Author Affiliation:** Dept. of Mech. Eng., Texas A&M Univ., College Station, TX, USA
**Journal:** Journal de Physique Colloque , vol.48 , no.C-8 , pp.377-81
**Country of Publication:** France
**Publication Date:** Dec. 1987
**Conference Title:** Fifth European Conference on Internal Friction and Ultrasonic Attenuation in Solids
**Conference Date:** 26-30 July 1987
**Conference Location:** Antwerp, Belgium
**Conference Sponsor:** CEC Belgian Phys. Soc. Eur. Phys. Soc. et al
**ISSN:** 0449-1947
**CODEN:** JPQCAK
**Language:** English
**Document Type:** Conference Paper in Journal (PA)
**Treatment:** Experimental (X)
**Abstract:** The PUCOT (piezoelectric ultrasonic composite oscillator technique) has been used at frequencies near 100 **kHz** to measure internal friction and dynamic **Young**'s **modulus** of various metal matrix composites (MMCs) and advanced alloys. The materials in the study were: Al/SiC MMCs with up to 20 volume % SiC and powder metallurgy (PM) Al-Fe-X alloys denoted as 452 and B014L. The testing was performed at various temperatures ranging from room temperature to over 300(deg)C. The strain amplitude dependence of internal friction was investigated over the strain range $10^{-8}$ to $10^{-4}$. The modulus data were fitted to a linear equation of the type: E=E(0)-MT, where E (**GPa**) is the dynamic modulus at temperature T ((deg)C), E(0) is the modulus at 0(deg)C and M is the slope dE/dT in **GPa**/(deg)C. The values of M for the materials studied varied in the range 0.03 to 0.10 **GPa**/(deg)C, while values of M/E(0) (=-(1/E)(dE/dT)) fell in the interval (4 to 9)x10 $^{-4}$ (deg)$C^{-1}$. The effects of a flash anneal (540(deg)C for 5 minutes) on the dynamic modulus (measured at room temperature) for the PM (powder metallurgy) aluminium specimens was also investigated. The PUCOT is described, and the **damping** and dynamic modulus data are discussed ( *6 refs.*)
**Subfile(s):** A (Physics)
**Descriptors:** aluminium alloys; composite materials; **damping**; internal friction; iron alloys; powder metallurgy; ultrasonic measurement; **Young**'s **modulus**
**Identifiers:** PUCOT; piezoelectric ultrasonic composite oscillator technique; internal friction; dynamic **Young**'s **modulus**; metal matrix composites; advanced alloys; powder metallurgy; strain amplitude dependence ; flash anneal; **damping**; AlSiC
**Classification Codes:** A4385 (Acoustical measurements and instrumentation); A6220D ( Elasticity, elastic constants); A6240 (Anelasticity, internal friction and mechanical resonances); A8140J (Elasticity and anelasticity)
**Chemical Indexing:**
Al/ss - Fe/ss
AlSiC/ss - Al/ss - Si/ss - C/ss
**INSPEC Update Issue:** 1988-013
**Copyright:** 1988, IEE
**Abstract:** The PUCOT (piezoelectric ultrasonic composite oscillator technique) has been used at frequencies near 100 **kHz** to measure internal friction and dynamic **Young**'s **modulus** of various metal matrix

composites (MMCs) and advanced alloys. The materials in the study were: Al/SiC MMCs with up to 20 volume % SiC and... ... strain range 10-8 to 10-4. The modulus data were fitted to a linear equation of the type: E=E(0)-MT, where E (**GPa**) is the dynamic modulus at temperature T ((deg)C), E(0) is the modulus at 0(deg)C and M is the slope dE/dT in **GPa**/(deg)C. The values of M for the materials studied varied in the range 0.03 to 0.10 **GPa**/(deg)C, while values of M/E(0) (=-(1/E)(dE/dT)) fell in the interval (4 to 9)x10 -4 (deg)C-1. The... ... minutes) on the dynamic modulus (measured at room temperature) for the PM (powder metallurgy) aluminium specimens was also investigated. The PUCOT is described, and the **damping** and dynamic modulus data are discussed
**Descriptors:** aluminium alloys; composite materials; **damping**; internal friction; iron alloys; powder metallurgy; ultrasonic measurement; **Young'**s **modulus**
**Identifiers:** PUCOT; piezoelectric ultrasonic composite oscillator technique; internal friction; dynamic **Young'**s **modulus**; metal matrix composites; advanced alloys; powder metallurgy; strain amplitude dependence ; flash anneal; **damping**; AlSiC (**19871200**)

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47/5,K/6 (Item 6 from file: 2)
DIALOG(R)File 2: INSPEC
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02652896
**Title:** **Young's modulus and mechanical damping of silver dental alloys**
**Author(s):** Wolfenden, A.; Hood, J.A.A.
**Author Affiliation:** Westinghouse Res. & Dev. Center, Pittsburgh, PA, USA
**Journal:** Journal of Materials Science , vol.15 , no.12 , pp.2995-3002
**Country of Publication:** UK
**Publication Date:** Dec. 1980
**ISSN:** 0022-2461
**CODEN:** JMTSAS
**Language:** English
**Document Type:** Journal Paper (JP)
**Treatment:** Experimental (X)
**Abstract:** The piezoelectric ultrasonic composite oscillator (PUCO) technique has been used at a frequency of 80 **kHz** to measure **Young'**s **modulus** and mechanical **damping** in eight silver dental alloys. The time dependence for aging at 37(deg)C and the temperature dependence of mechanical **damping** over the temperature range of 20 to 80(deg)C were studied. **Young'**s **modulus** (measured at 37(deg)C) increased from around 17 **GPa** after 15 min and saturated near 70 **GPa** after $10^3$ to $10^4$ min. The mechanical **damping** increased by factors of 6 to 32 over the investigated temperature range, whereas **Young's** **modulus** decreased by 1.3 to 5%. Arrhenius plots of the data gave effective activation energies ranging from 0.35 to 3.1 eV. The results are interpreted in terms of various diffusion processes in the alloys and in terms of the microstructures ( *15 refs.*)
**Subfile(s):** A (Physics)
**Descriptors:** **damping**; internal friction; mercury alloys; silver alloys; tin alloys; **Young'**s **modulus**

**Identifiers:** **Young's modulus;** mechanical **damping;** piezoelectric ultrasonic composite oscillator; PUCO; time dependence; aging ; temperature dependence; mechanical **damping;** 20 to 80degrees C; Arrhenius plots; activation energies; diffusion processes; microstructures; Ag dental alloys; internal friction; Ag-Hg-Sn alloys
**Classification Codes:** A6220D (Elasticity, elastic constants ); A6240 (Anelasticity, internal friction and mechanical resonances); A8140J (Elasticity and anelasticity); A8770J (Prosthetics and other practical applications)
**INSPEC Update Issue:** 1981-004
**Copyright:** 1981, IEE
**Title:** **Young's modulus and mechanical damping of silver dental alloys**
**Abstract:** The piezoelectric ultrasonic composite oscillator (PUCO) technique has been used at a frequency of 80 **kHz** to measure **Young**'s **modulus** and mechanical **damping** in eight silver dental alloys. The time dependence for aging at 37(deg)C and the temperature dependence of mechanical **damping** over the temperature range of 20 to 80(deg)C were studied. **Young**'s **modulus** (measured at 37(deg)C) increased from around 17 **GPa** after 15 min and saturated near 70 **GPa** after 103 to 104 min. The mechanical **damping** increased by factors of 6 to 32 over the investigated temperature range, whereas **Young**'s **modulus** decreased by 1.3 to 5%. Arrhenius plots of the data gave effective activation energies ranging from 0.35 to 3.1 eV. The results...
**Descriptors:** **damping;** internal friction; mercury alloys; silver alloys; tin alloys; **Young**'s **modulus**
**Identifiers:** **Young's modulus;** mechanical **damping;** piezoelectric ultrasonic composite oscillator; PUCO; time dependence; aging ; temperature dependence; mechanical **damping;** 20 to 80degrees C; Arrhenius plots; activation energies; diffusion processes; microstructures; Ag dental alloys; internal friction; Ag-Hg-Sn alloys
(**19801200**)

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47/5,K/8 (Item 1 from file: 5)
DIALOG(R)File 5: Biosis Previews(R)
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13705563 **Biosis No.:** 199799339623
**A comparison of elastic moduli derived from theory, microindentation, and ultrasonic testing**

**Author:** Lum Susan K; Duncan-Hewitt Wendy C (Reprint)
**Author Address:** Sch. Pharm., Tex. Tech, Amarillo, TX 79106, USA**USA
**Journal:** Pharmaceutical Research (New York) 113 ( 11 ): p 1739-1745 1996 **1996**
**ISSN:** 0724-8741
**Document Type:** Article
**Record Type:** Abstract
**Language:** English

**Abstract:** Purpose. The objective of our work was to evaluate the **elastic modulus** through ultrasonic testing of poly(methyl methacrylate-co-methacrylic acid) (PMMA/coMAA), a viscoelastic polymer similar to the commercial Eudragit, to calculate this modulus, assuming a regular

arrangement of interacting groups, and ultimately, assess the accuracy of microindentation as a means of evaluating elasticity in very small samples. Methods. Knoop indentation testing was performed on cast samples using a Tukon testing apparatus. Solid density and pulse echo testing employing a **damped** 15 **MHz** transducer served to quantify the **elastic moduli**. Using the Hoy method of calculation for molar attraction constants, and assuming pairwise addition, the modulus was calculated and compared with typical experimental values for amorphous and crystalline polymers. Results. Acoustic testing resulted in an average **elastic modulus** value of 5.67 +- 0.2 **GPa** for this copolymer, which concurs with literature values for PMMA. Acoustically derived experimental moduli when normalized and plotted against calculated values, resulted in a relationship, E/(1 - 2-upsilon) = 17.0 (E-coh + x-c-DELTA-Hm)/V + 6.9, similar to that predicted in theory. Conclusions. Indentation contact modeling does not adequately describe the real recovery under indentation. In contrast, acoustic testing of pharmaceutical materials affords a simple, reproducible means of characterizing moduli without impairing structural integrity. Acoustically derived moduli further afford insight into the intermolecular interactions, as expressed by the interaction energy terms.

**DESCRIPTORS:**
**Major Concepts:** Biochemistry and Molecular Biophysics; Pharmacology
**Miscellaneous Terms: Concept Codes:** pharmaceutical industry; ANALYTICAL METHOD; BIOBUSINESS; **ELASTIC MODULUS**; INTERMOLECULAR INTERACTIONS; MICROINDENTATION; MODELS AND SIMULATIONS; PHARMACEUTICAL MATERIALS; PHARMACEUTICALS; POLY(METHYL METHACRYLATE-CO-METHACRYLIC ACID); ULTRASONIC TESTING; VISCOELASTIC POLYMER
**Concept Codes:**
10050 Biochemistry methods - General
10060 Biochemistry studies - General
10502 Biophysics - General
10506 Biophysics - Molecular properties and macromolecules
10608 External effects - Sonics and ultrasonics
22002 Pharmacology - General

**A comparison of elastic moduli derived from theory, microindentation, and ultrasonic testing**

**Series Title: 1996**

**Abstract:** Purpose. The objective of our work was to evaluate the **elastic modulus** through ultrasonic testing of poly(methyl methacrylate-co-methacrylic acid) (PMMA/coMAA), a viscoelastic polymer similar to the commercial Eudragit, to calculate this modulus, assuming... ...very small samples. Methods. Knoop indentation testing was performed on cast samples using a Tukon testing apparatus. Solid density and pulse echo testing employing a **damped** 15 **MHz** transducer served to quantify the **elastic moduli**. Using the Hoy method of calculation for molar attraction constants, and assuming pairwise addition, the modulus was calculated and compared with typical experimental values for amorphous and crystalline polymers. Results. Acoustic testing resulted in an average **elastic modulus** value of 5.67 +- 0.2 **GPa** for this copolymer, which concurs with literature values for PMMA. Acoustically derived experimental moduli when normalized and plotted against calculated values, resulted in a relationship...

**DESCRIPTORS:**
**Miscellaneous Terms: Concept Codes: ...ELASTIC MODULUS;**

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47/5,K/9 (Item 1 from file: 8)
DIALOG(R)File 8: Ei Compendex(R)
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0012754903 **E.I. COMPENDEX No:** 1992090909999
**Anelastic and elastic measurements in aluminum metal matrix composites**

Wolfenden, Alan; Harmouche, Mahmoud R.; Hayes, Steven V.
**Corresp. Author/Affil:** Wolfenden, Alan: Texas A&M Univ, United States
**Conference Title:** Testing Technology of Metal Matrix Composites
**Conference Location:** Nashville, TN, USA **Conference Date:** 19851118-19851120
**Sponsor:** ASTM, Committee D-30 on High Modulus Fibers and their Composites,
ASTM Special Technical Publication ( ASTM Spec Tech Publ ) **1988** STP/964 (207-215)
**Publication Date:** 19881201
**Publisher:** Publ by ASTM
**CODEN:** ASTTA **ISSN:** 1040-3094
**Document Type:** Conference Paper; Conference Proceeding **Record Type:** Abstract
**Treatment:** X; (Experimental)
**Language:** English **Summary Language:** English
**Number of References:** 7
The piezoelectric ultrasonic composite oscillator technique (PUCOT) has been used at temperatures up to 638 K and at 80 **kHz** to measure dynamic **Young's modulus** E, mechanical **damping** or internal friction Q SUP -1 and strain amplitude epsilon in Al/SiC SUB w and Al/SiC SUB p. For four adjacent specimens from one sheet of 6061 Al/SiC SUB p E-values varied in the range 114-119 **GPa** at room temperature. The composition dependence of the modulus followed E = 68.6 + 2.2X with R = 0.95 (E is in **GPa** and X in volume percent SiC). The temperature dependence of the dynamic modulus followed E = 138.7 - 0.11T with R = 0.98 (E is in **GPa** and T in Kelvin). The amplitude dependence of Q SUP -1 for 6061 Al/SiC SUB w revealed a **damping** peak at epsilon = 10 SUP -6. An analysis of the internal friction data in terms of a **damping** theory yielded values for the minor pinning length of dislocation lines and the density of mobile dislocations. The results are discussed in terms of the microstructure.
**Descriptors:** Aluminum and Alloys; Elasticity; Materials Testing--Mechanical Properties; Silicon Carbide; *Composite Materials
**Identifiers:** Anelasticity; Dynamic Modulus; Internal Friction; Metal Matrix Composites; Piezoelectric Ultrasonic Composite Oscillator Technique
**Classification Codes:**
421 (Strength of Building Materials; Mechanical Properties)
531 (Metallurgy & Metallography)
541 (Aluminum & Alloys)
804 (Chemical Products Generally)
812 (Ceramics, Refractories & Glass)

**1988**

The piezoelectric ultrasonic composite oscillator technique (PUCOT) has been used at temperatures up to 638 K and at 80 **kHz** to measure dynamic **Young's modulus** E, mechanical **damping** or internal friction Q SUP -1 and strain amplitude epsilon in Al/SiC SUB w and Al/SiC SUB p. For four adjacent specimens from one sheet of 6061 Al/SiC SUB p E-values varied in the range 114-119 **GPa** at room temperature. The composition dependence of the modulus followed E = 68.6 + 2.2X with R = 0.95 (E is in **GPa** and X in volume percent SiC). The temperature dependence of the dynamic modulus followed E = 138.7 - 0.11T with R = 0.98 (E is in **GPa** and T in Kelvin). The amplitude dependence of Q SUP -1 for 6061 Al/SiC SUB w revealed a **damping** peak at epsilon = 10 SUP -6. An analysis of the internal friction data in terms of a **damping** theory yielded values for the minor pinning length of dislocation lines and the density of mobile dislocations. The results are discussed in terms of the...

**Descriptors:**

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**Dialog eLink:** USPTO Full Text Retrieval Options

47/5,K/10 (Item 1 from file: 14)

DIALOG(R)File 14: Mechanical and Transport Engineer Abstract

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0000538477 IP Accession No: 200607-61-43292

**Electrostatic microresonators from doped hydrogenated amorphous and nanocrystalline silicon thin films**

Gaspar, J; Chu, V; Conde, J P

IEEE Journal of Microelectromechanical Systems , v 14 , n 5 , p 1082-1088 , Oct. 2005
**Publication Date: 2003**
**Publisher:** Institute of Electrical and Electronics Engineers, Inc. , 445 Hoes Ln , Piscataway , NJ , 08854-1331
**Country Of Publication:** USA
**Publisher Url:** http://ieee.org
**Publisher Email:** inspec@ieee.org

**Document Type:** Journal Article
**Record Type:** Abstract
**Language:** English
**ISSN:** 1057-7157
**Electronic Issn:** NO
**DOI:** 10.1109/JMEMS.2005.851808
**File Segment:** Mechanical & Transportation Engineering Abstracts

**Abstract:**
This paper reports on the fabrication and characterization of flexural electrostatic microresonators based on doped thin-film hydrogenated amorphous and nanocrystalline silicon processed at temperatures below 110 deg C using surface micromachining on

glass substrates. The microelectromechanical structures are bridges made of either phosphorus-doped hydrogenated amorphous silicon (n/sup /-a-Si:H) deposited by plasma-enhanced chemical vapor deposition (PECVD) or boron-doped hydrogenated nanocrystalline silicon (p/sup /-nc-Si:H) deposited by hot-wire chemical vapor deposition (HWCVD). The microbridges, which are suspended over an aluminum (Al) gate electrode, are electrostatically actuated and the mechanical resonance is detected in vacuum using an optical detection method. The **resonance frequency** and energy **dissipation** mechanisms involved in thin-film silicon based microresonators are studied as a function of the geometrical dimensions of the structures. Resonance frequencies up to 36 **MHz** are observed and a **Young**'s **modulus** of 147 **GPa** is extracted for n/sup /-a-Si:H, and of 165 **GPa** for the p/sup /-nc-Si:H films. Quality factors as high as 5000 and 2000 are observed for the n/sup /-a-Si:H and p/sup /-nc-Si:H resonators, respectively, and are limited by surface losses. The effect on the resonance frequency and quality factor of depositing a metal layer on the thin-film silicon structural layer is studied.

**Descriptors:** Chemical vapor deposition; Microorganisms; Nanocrystals; Silicon; Deposition; Silicon substrates; Aluminum; Electrostatics; Quality factor; Glass; Microelectromechanical systems; Gates; Resonators; **Modulus** of **elasticity**; Micromachining; Silicon films; Geometry; Industrial engineering; Amorphous silicon; Dimensions
**Subj Catg:** 61, Design Principles
**Publication Date: 2003**

**Abstract:**
...are suspended over an aluminum (Al) gate electrode, are electrostatically actuated and the mechanical resonance is detected in vacuum using an optical detection method. The **resonance frequency** and energy **dissipation** mechanisms involved in thin-film silicon based microresonators are studied as a function of the geometrical dimensions of the structures. Resonance frequencies up to 36 **MHz** are observed and a **Young**'s **modulus** of 147 **GPa** is extracted for n/sup /-a-Si:H, and of 165 **GPa** for the p/sup /-nc-Si:H films. Quality factors as high as 5000 and 2000 are observed for the n/sup /-a-Si:H...

**Descriptors:** Chemical vapor deposition; Microorganisms; Nanocrystals; Silicon; Deposition; Silicon substrates; Aluminum; Electrostatics; Quality factor; Glass; Microelectromechanical systems; Gates; Resonators; **Modulus** of **elasticity**; Micromachining; Silicon films; Geometry; Industrial engineering; Amorphous silicon; Dimensions
**Identifiers:**

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47/5,K/17 (Item 1 from file: 95)
DIALOG(R)File 95: TEME-Technology & Management
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01465273 20001107089

**Influence of high-energy impact actions on the elastic and anelastic properties of martensitic Cu-Al-Ni crystals**

Emelyanov, Yu; Golyandin, S; Kobelev, NP; Kustov, S; Nikanorov, S; Pugachev, G; Sapozhnikov, K; Sinani, A; Soifer, YM; Van Humbeeck, J; De Batist, R
A.F. Ioffe Phys. Inst., Acad. of Sci., St. Petersburg, RU
12th International Conference on Internal Friction and Ultrasonic Attenuation in Solids, 19-23 July 1999, Buenos Aires, Argentina Journal of Alloys and Compounds, v310, n1/2, pp324-329 , **2000**
**Document type:** journal article; 06 Conference paper **Language:** English
**Record type:** Abstract
**ISSN:** 0925-8388

**Abstract:**
The influence of high-energy impact shock-wave loading on the microplasticity and macroscopic performance of the Cu-Al-Ni crystals in the beta (ind 1)' martensitic phase has been studied. Elastic and anelastic properties of quenched and aged polyvariant single crystals before and after impact shock-wave loading were measured in the temperature range 80-300 K, at a frequency of about 100 **kHz** in the strain amplitude-independent and amplitude-dependent ranges by means of the composite oscillator technique, and in the **MHz** frequency range using the pulse-echo technique. High-velocity impact loading of the specimens was realised by plane shock-waves with stress pulses with a duration of approximately 2.10(exp -6) s and stress amplitudes up to 5 **GPa**. A pronounced influence of impact shock-wave loading on the elastic and anelastic properties of the beta (ind 1)' martensite has been observed. A strongly marked softening of the material and an enhancement of **damping** properties are revealed up to the highest stress pulse amplitudes. This behaviour differs fundamentally from the one observed in 'ordinary' FCC metals. Changes of the defect structure induced by shock-wave loading, which may be responsible for the observed phenomena, have been discussed.

**Descriptors:** AGEING--MATERIALS; CUPROALUMINIUM; COPPER ALLOYS; ATTENUATION; IMPACT-- MECHANICAL; INTERNAL FRICTION; MARTENSITE; NICKEL ALLOYS; QUENCHING-- COOLING; SOFTENING; **YOUNG MODULUS; ELASTIC** PROPERTIES; ANELASTICITY; PULSE ECHO METHOD; DEFECT STATES; TEMPERATURE DEPENDENCE; MARTENSITIC TRANSFORMATION; IMPULSE WAVE
**Identifiers:** UNELASTISCHE RELAXATION; STOSSWELLENEFFEKT; ULTRASCHALLGESCHWINDIGKEIT; UNELASTISCHE EIGENSCHAFT; STOERSTELLENSTRUKTUR; 100 **KILOHERTZ** BEREICH; Cu-Al-Ni-Einkristall; Stosswelle; Elastizitaet; Anelastizitaet , **2000**

**Abstract:**
...polyvariant single crystals before and after impact shock-wave loading were measured in the temperature range 80-300 K, at a frequency of about 100 **kHz** in the strain amplitude-independent and amplitude-dependent ranges by means of the composite oscillator technique, and in the **MHz** frequency range using the pulse-echo technique. High-velocity impact loading of the specimens was realised by plane shock-waves with stress pulses with a duration of approximately 2.10(exp -6) s and stress amplitudes up to 5 **GPa**. A pronounced influence of impact shock-wave loading on the elastic and anelastic properties of the beta (ind 1)' martensite has been observed. A strongly marked softening of the

material and an enhancement of **damping** properties are revealed up to the highest stress pulse amplitudes. This behaviour differs fundamentally from the one observed in 'ordinary' FCC metals. Changes of the...

**Descriptors:** ...COOLING; SOFTENING; **YOUNG MODULUS; ELASTIC** PROPERTIES; ANELASTICITY; PULSE ECHO METHOD; DEFECT STATES; TEMPERATURE DEPENDENCE; MARTENSITIC TRANSFORMATION; IMPULSE WAVE
**Identifiers:** UNELASTISCHE RELAXATION; STOSSWELLENEFFEKT; ULTRASCHALLGESCHWINDIGKEIT; UNELASTISCHE EIGENSCHAFT; STOERSTELLENSTRUKTUR; 100 **KILOHERTZ** BEREICH; Cu-Al-Ni-Einkristall; Stosswelle; Elastizitaet; Anelastizitaet

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47/5,K/18 (Item 2 from file: 95)
DIALOG(R)File 95: TEME-Technology & Management
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01256557 W98110094427
**Measurements of dynamic elastic modulus, vibration damping, and other physical properties of the Zr57Ti5Al10Cu20Ni8 amorphous alloys in the amorphous and crystalline states**

Wolfenden, A; Barrios, KA; Xing, LQ
Texas A & M Univ., College Station, USA; IFW Dresden, Inst. f. Metallic Materials, D
Journal of Materials Science Letters, v17, n13, pp1095-1097 , **1998**
**Document type:** journal article **Language:** English
**Record type:** Abstract
**ISSN:** 0261-8028

**Abstract:**
Die amorphe Legierung Zr57Ti5Al10Cu20Ni8 wurde durch Abschrecken der Schmelze in eine wassergekuehlte Kupferform hergestellt. Durch Gluehen bei 500 Grad C fuer 1 h wurde der kristalline Zustand der Legierung erreicht. Folgende Messungen wurden im amorpen sowie im kristallinen Zustand durchgefuehrt: Ultraschallmessungen bei 80 **kHz** zur Ermittlung des dynamischen Elastizitaetsmoduls, des Schubmoduls und der Daempfung, Messungen des elektrischen Widerstands, der Mikrohaerte, der Kristallisationsemthalpie mit Hilfe der Differentialrasterkalorimetrie und Roentgenbeugungsmessungen zur Bestimmung der Kristallstruktur. Die Probenoberflaechen wurden mit optischer Mikroskopie untersucht. Folgende quantitative Ergebnisse wurden erhalten (Die Werte in Klammern beziehen sich jeweils auf den kristallinen Zustand): Elastizitaetsmodul 86,9 **GPa** (89,0 **GPa**), Schubmodul 35,4 **GPa** (36,2 **GPa**), Daempfung 4,75x10(exp -4) (6,90x10(exp -4)), Kristallisationsenthalpie 64,6 J/g (0,00), Mikrohaerte 504 H(ind v) (638 H(ind v)), elektrischer Widerstand 2,77x10(exp -6) Ohm.m (1,92x10(exp -6) Ohm.m).

**Descriptors:** EXPERIMENTAL STUDY; AMORPHOUS ALLOYS; ZIRCONIUM

ALLOYS; TITANIUM ADDITION; ALUMINIUM ADDITION; COPPER ADDITION; NICKEL ADDITION; AMORPHIZATION CRYSTALLIZATION; LIGHT MICROSCOPY; DYNAMIC **MODULUS OF ELASTICITY**; COULOM **MODULUS**; INTERNAL FRICTION; ANELASTICITY; MICROHARDNESS; ULTRASONIC WAVES; ACOUSTICAL WAVE ATTENUATION MEASUREMENT; CONDUCTIVITY--ELECTRICAL; DIFFERENTIAL SCANNING CALORIMETRY; CRYSTALLISATION; ENTHALPY; X RAY DIFFRACTION; DENSITY--MASS PER VOLUME; ANNEALING--HEAT TREATMENT; SURFACE STRUCTURE; PRECIPITATION
**Identifiers:** KRISTALLISATIONSENTHALPIE; ZIRCONIUMKUPFERALUMINIUMLEGIERUNG; amorphe Zr-Legierung; physikalische Eigenschaft
**Measurements of dynamic elastic modulus, vibration damping, and other physical properties of the Zr57Ti5Al10Cu20Ni8 amorphous alloys in the amorphous and crystalline states**
**, 1998**

**Abstract:**
...Grad C fuer 1 h wurde der kristalline Zustand der Legierung erreicht. Folgende Messungen wurden im amorpen sowie im kristallinen Zustand durchgefuehrt: Ultraschallmessungen bei 80 **kHz** zur Ermittlung des dynamischen Elastizitaetsmoduls, des Schubmoduls und der Daempfung, Messungen des elektrischen Widerstands, der Mikrohaerte, der Kristallisationsemthalpie mit Hilfe der Differentialrasterkalorimetrie und Roentgenbeugungsmessungen zur... ...Probenoberflaechen wurden mit optischer Mikroskopie untersucht. Folgende quantitative Ergebnisse wurden erhalten (Die Werte in Klammern beziehen sich jeweils auf den kristallinen Zustand): Elastizitaetsmodul 86,9 **GPa** (89,0 **GPa**), Schubmodul 35,4 **GPa** (36,2 **GPa**), Daempfung 4,75x10(exp -4) (6,90x10(exp -4)), Kristallisationsenthalpie 64,6 J/g (0,00), Mikrohaerte 504 H(ind v) (638 H(ind v...

**Descriptors:** EXPERIMENTAL STUDY; AMORPHOUS ALLOYS; ZIRCONIUM ALLOYS; TITANIUM ADDITION; ALUMINIUM ADDITION; COPPER ADDITION; NICKEL ADDITION; AMORPHIZATION CRYSTALLIZATION; LIGHT MICROSCOPY; DYNAMIC **MODULUS OF ELASTICITY**; COULOM **MODULUS**; INTERNAL FRICTION; ANELASTICITY; MICROHARDNESS; ULTRASONIC WAVES; ACOUSTICAL WAVE ATTENUATION MEASUREMENT; CONDUCTIVITY...
**Identifiers:**

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47/5,K/19 (Item 1 from file: 103)
DIALOG(R)File 103: Energy SciTec
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03792636 EDB-95-036404
**Title: Damping at high homologous temperature in pure Cd, In, Pb, and Sn**
Author(s): Cook, L.S.; Lakes, R.S. (Univ. of Iowa, Iowa City, IA

(United States))
Source: Scripta Metallurgica et Materialia (United States) v 32:5 .
**Coden:** SCRMEX **ISSN:** 0956-716X

**Publication Date:** 1 Mar **1995** p 773-777
**Document Type:** Journal Article; Numerical Data
**Language:** English
**Journal Announcement:** EDB9506
**Subfile:** ETD (Energy Technology Data Exchange); INS (US Atomindex input) . IMS (DOE contractor)
**US DOE Project/NonDOE Project:** NP
**Country of Origin:** United States
**Country of Publication:** United States
**Abstract:** Typically, if a material possesses the stiffness necessary to be considered a structural material, its **damping** is low. Conversely, materials with high **damping** usually do not possess the stiffness necessary to be considered a structural material. Candidate materials for the high stiffness-low **damping** phase exist in abundance, whereas candidate materials for the moderate stiffness-high **damping** phase remain to be identified. One possible class of candidate materials for the moderate stiffness-high **damping** phase is metals at high homologous temperatures. **Shear moduli** of the specimens at 100 **Hz** are as follows: 4.1 **GPa** for indium, 5.7 **GPa** for lead, 15.7 **GPa** for tin, and 20.7 **GPa** for cadmium. Considering the behavior typical of metals, one may think of In and Pb as relatively compliant, while Sn and Cd could be called moderately stiff. The results are of some technological interest in view of the utility of materials with moderately high stiffness and **damping**. The combination of moderate stiffness and reasonably high loss tangent makes Cd the most promising metal tested with respect to technological applications. The **shear modulus** of Cd was highest of the metals tested (and very near that of aluminum (G = 27 **GPa**), which exhibits a loss tangent of about 0.001 at room temperature). The loss tangent of Cd at audio-frequencies was as high or higher than that of the other metals. In addition, frequency dependence of loss tangent was not as large as that observed in the other metals. No clear pattern relating **damping** to melting point emerged. An understanding in terms of viscoelastic mechanisms is not forthcoming at this time. Among the metal studied, cadmium exhibited a substantial loss tangent of 0.03 to 0.04 over much of the audio range, combined with a moderate stiffness, G = 20.7 **GPa**.
**Major Descriptors:** *CADMIUM -- **DAMPING**; *CADMIUM -- SHEAR PROPERTIES; *INDIUM -- **DAMPING**; *INDIUM -- SHEAR PROPERTIES; *LEAD -- **DAMPING**; *LEAD -- SHEAR PROPERTIES; *TIN -- **DAMPING**; *TIN -- SHEAR PROPERTIES
**Descriptors:** EXPERIMENTAL DATA; MECHANICAL PROPERTIES; MICROSTRUCTURE; STRUCTURAL MODELS
**Broader Terms:** DATA; ELEMENTS; INFORMATION; MECHANICAL PROPERTIES; METALS; NUMERICAL DATA
**Subject Categories:** 360103* -- Metals & Alloys -- Mechanical Properties
360104 -- Metals & Alloys -- Physical Properties
**INIS Subject Categories:** B2230* -- Metals & Alloys -- Mechanical properties
B2242 -- Metals & Alloys -- Other physical properties -- (1992-)
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